PATENT ABSTRACTS OF JAPAN

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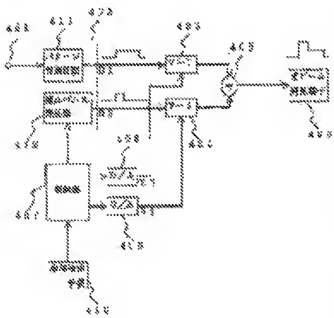
(71)Applicant : PIONEER ELECTRON CORP
(72)Inventor : KURIBAYASHI HIROKI

(54) OPTICAL INFORMATION RECORDING DEVICE AND OPTICAL INFORMATION RECORDING MEDIUM



(57)Abstract:
PROBLEM TO BE SOLVED: To prevent the damaging of a recording range by suppressing the level of a multivalue recording optical signal for teardrop correction in a CAV format according to a recording radius.
SOLUTION: A pattern determination circuit 411 sends the wave form of a rectangular wave DI as a base portion of a ternary signal to a V-I converter 403 according to a recording data signal from an input terminal 401. A control section 407 sends, based on recording radius information from a radius detecting means 410, a driving signal EO for deciding the output level of an optical beam corresponding to the basic rectangular wave DI to the V-I converter 403. Herein, a correction pulse generating section 412 sends the wave form of an upper rectangular wave D2 for correcting a teardrop shape to a V-I converter 402. The control section 407 sends a driving signal E1 for deciding the output level of the upper rectangular wave D2 to a V-I converter 404 but lowers the level according to a radius in a range where a recording radius exceeds a specified value.

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CLAIMS

[Claim(s)]

[Claim 1] Moving relatively an optical information record medium and the optical head which has a light beam generating means In the optical information recording device which forms the pit corresponding to a recording information signal in the light beam outputted from the light beam generating means, and records information on the record film currently formed on the optical information record medium It has a record location detection means to detect the record location currently recorded on said optical information record medium, and the control means which controls said light beam generating means. Said control means The optical information recording device characterized by controlling the output of the light beam from said light beam generating means according to the record positional information outputted from said record location detection means.

[Claim 2] Said control means is an optical information recording device according to claim 1 characterized by making the light beam which has the power level more than binary from said light beam generating means output, and changing the greatest power level of a light beam at least according to said record positional information in case a pit is formed.

[Claim 3] Said control means is claim 1 characterized by making adjustable [of a generating termination time] possible according to said record positional information at the generating initiation time of said light beam in case a pit is formed, or an optical information recording device according to claim 2.

[Claim 4] In case said control means forms a pit, when said record positional information

is smaller than a predetermined value A generating termination time is delayed predetermined time rather than a generating termination time at the generating initiation time of said recording information signal, respectively at said light beam generating initiation time. When said record positional information is larger than a predetermined value Claim 1 characterized by controlling to delay said light beam generating termination time predetermined time, claim 2, or an optical information recording device according to claim 3.
[Claim 5] Said record location detection means is claim 1 characterized by detecting a record location based on the information included in said recording information signal, claim 2, claim 3, or an optical information recording device according to claim 4.
[Claim 6] Said record location detection means is claim 1 characterized by detecting a record location based on the information beforehand recorded on said optical information record medium, claim 2, claim 3, or an optical information recording device according to claim 4.
[Claim 7] The optical information record medium characterized by recording beforehand the control information for changing the light beam output from an optical information recording apparatus in the optical information record medium which records information by forming the pit corresponding to a recording information signal in the light beam outputted from the light beam generating means.
[Claim 8] The optical information record medium according to claim 7 with which said control information is characterized by being a hour entry.
[Claim 9] The optical information record medium according to claim 7 with which said control information is characterized by being positional information.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the optical information recording device and the optical information record medium which perform informational record and elimination using the crystallized state of a recording layer changing by making a light beam condense on the recording surface of an optical information record medium.
[0002]

[Description of the Prior Art] The optical information record medium which can eliminate and rewrite recording information in recent years attracts attention. For example, with the optical information record medium of a phase change mold, information recorded by recording information by changing the crystallized state of a recording layer, and detecting reflection factor change of the recording layer accompanying such a change of state by the irradiated light beam at the time of playback is reproduced among rewritable optical information record media.

[0003] As an approach of recording information on the optical information record medium in which such rewriting is possible, power level of a light beam is made binary with high level and a low level according to the information bit (1 or 0) which should be recorded, and the approach of recording by irradiating the light beam at an optical information record medium is learned.

[0004] However, by the record approach by this binary signal, in the recording start edge on a record medium, since heat energy is accumulated by operation of heat conduction as it is used as energy for a part of heat energy changed from light energy to heat a record part beforehand and results in record termination one end, the flat-surface configuration of the formed pit may turn into the so-called broad tear drop configuration (teardrop configuration) as it results in a trailer.

[0005] If the flat-surface configuration of a pit turns into a tear drop configuration, since the start edge and termination of a pit will not be formed correctly, in the optical information record medium which detects the start edge location and termination location of a pit, and reproduces a signal, a jitter (the amount of fluctuation of the start edge of the pit to a detection width of window and termination) becomes large, and an exact playback wave is no longer acquired.

[0006] For this reason, the record approach by the so-called multiple-value signal of changing the power level of a light beam irradiated in order to record information more than a three-stage is learned. This makes a record medium generate heat rapidly by giving the light beam of power level also with the high high-level twist of a binary signal at the time of a recording start, i.e., exposure initiation of a light beam, in case a pit is formed, makes the whole heating value homogeneity by lowering the power level of a light beam in consideration of the cumulative effect of heat one by one henceforth, and is the record approach of controlling distortion of the configuration of the pit formed and aiming at an error and reduction of a jitter.

[0007] Here, the record approach by binary, three values, and the multiple-value signal is explained in detail with reference to drawing 9 . Drawing 9 shows the relation between the power level of the light beam output irradiated by the record location when record by the binary signal, 3 value signals, and the multiple-value signal is performed, the temperature distribution of the part by which the light beam was irradiated, and the pit configuration formed, respectively, and a light beam is explained as what moves toward the right from the left as the arrow head of the record direction showed to this drawing.

[0008] It is the case where it records in the binary signal of high level P0 and a low level B, and as temperature distribution showed in this drawing, as for drawing 9 (a), it turns out that the pit which serves as the form where it integrated with the wave of the power level of a light beam output, consequently is formed serves as a tear drop configuration.

[0009] Drawing 9 (b) can make the pit which it is the case where it records by 3 value signals which applied the level P1 only with dP still higher than P0. temperature goes up to the above-mentioned binary signals P0 and B rapidly at a recording start edge since the standup configuration of temperature distribution becomes steep an outputted part of dP, consequently is formed in them the configuration by which distortion by the recording start edge was amended.

[0010] Drawing 9 (c) is the case where it records in the light beam which divided the power level of a light beam output into the multistage story rather than 3 value signals of drawing 9 (b), and can be brought close to the configuration of the pit for which it asks more finely than the 3 above-mentioned value signals.

[0011] by the way -- the recording method of a record medium -- the linear velocity at the time of record -- regularity -- that is A rotational frequency changes according to the record location (a record radius is called below) in radial [of a record medium]. The format to which a rotational frequency decreases, so that it goes to a periphery (CLV format: Constant Linear Velocity format), The angular rate of rotation to the record radius of a record medium responds to regularity, and linear velocity responds to a record radius, it changes, and it is divided roughly into two of the formats (CAV format: Constant Angular Velocity format) which linear velocity increases, so that it goes to a periphery.

[0012] Since linear velocity increases so that it goes in the direction of a periphery, as mentioned above when recording in a CAV format, the time amount to which the light beam is irradiating per unit area of a record part becomes short, and the heating value generated in per unit area falls. Therefore, it is necessary to make the power of a light beam increase, when recording in a CAV format as it goes to a periphery.

[0013] drawing 10 showed the relation between the record radius at the time of performing record by CAV format, taking into consideration the point mentioned above (axis of abscissa), and the power level (axis of ordinate) of the light beam output to irradiate -- it is. Among this drawing, when P1 amends distortion of a teardrop configuration by showing the high-level value of the binary signal in the case of drawing 9 (a) when P0 does not take distortion of a teardrop configuration into consideration that is, that is, the value which added dP to P0 in the case of drawing 9 (b) is shown.

[0014] However, if a record radius shows a record-medium periphery, so that it goes to the right, and MaxPower shows the rated level (operating-limits level) of a light beam light emitting device among this drawing and the power level of a light beam output exceeds this value, degradation of a component shall be remarkable and a life shall become short. Since linear velocity increases so that it goes to the periphery section, in the CAV format, the power level P0 and P1 of a light beam is also high in connection with it at the time of record, so that it may understand, even if it sees this drawing.

[0015] Therefore, when recording towards the periphery section from the inner circumference section in the binary signal of only the power level of P0, a light beam output is Max. It can be called the limitation which can record the radius location R2 which reaches Power. However, if it records similarly [in the light beam of the multiple-value signal containing the power level of P1], when it comes to R1 located in an inner circumference side rather than it before going to R2, MaxPower will be reached and the recordable range will narrow. That is, if it records by the multiple-value signal in order to

control distortion of the pit of a teardrop configuration, the record radius corresponding to the rated value of a light beam light emitting device will become short, and a result by which the record range is spoiled will be brought.

[0016]

[Problem(s) to be Solved by the Invention] The place which it is made in order that this invention may solve such a problem, and is made into the purpose is to offer the optical information recording device which controls that the pit further formed in the teardrop configuration has a bad influence on playback, without spoiling the record range, in case CAV format record is performed.

[0017]

[Means for Solving the Problem] It is what was considered in order that this invention might solve the above technical problems. An optical-recording-medium recording device according to claim 1 Moving relatively an optical information record medium and the optical head which has a light beam generating means In the optical information recording device which forms the pit corresponding to a recording information signal in the light beam outputted from the light beam generating means, and records information on the record film currently formed on the optical information record medium It has a record location detection means to detect the record location currently recorded on an optical information record medium, and the control means which controls a light beam generating means, and a control means is characterized by to control the output of the light beam from a light beam generating means according to the record positional information outputted from a record location detection means.

[0018] Moreover, invention according to claim 2 is invention according to claim 1, and in case a control means forms a pit, it makes the light beam which has the power level more than binary from a light beam generating means output, and changes the greatest power level of a light beam at least according to record positional information.

[0019] Moreover, invention according to claim 3 is invention according to claim 2, and in case a control means forms a pit, it makes adjustable [of a generating termination time] possible according to record positional information at the generating initiation time of said light beam.

[0020] Invention according to claim 4 is any one invention of claim 1 thru/or claim 3. Moreover, a control means In case a pit is formed, when record positional information is smaller than a predetermined value At the light beam generating initiation time, a generating termination time is delayed predetermined time rather than a generating termination time at the generating initiation time of a recording information signal, respectively, and when record positional information is larger than a predetermined value, it controls to delay a light beam generating termination time predetermined time.

[0021] Moreover, invention according to claim 5 is any one invention of claim 1 thru/or claim 4, and a record location detection means detects a record location based on the information included in a recording information signal.

[0022] Moreover, invention according to claim 6 is any one invention of claim 1 thru/or claim 4, and a record location detection means is detected based on the information beforehand recorded on the optical information record medium.

[0023] Moreover, when invention according to claim 7 forms the pit corresponding to a

recording information signal in the light beam outputted from the light beam generating means, in the optical information record medium which records information, the control information for changing the light beam output from an optical information recording apparatus is recorded beforehand.

[0024] Moreover, invention according to claim 8 is invention according to claim 7, and control information is a hour entry.

[0025] Moreover, invention according to claim 9 is invention according to claim 7, and control information is positional information.

[0026]

[Function] Moving relatively an optical information record medium and the optical head which has a light beam generating means according to invention according to claim 1 In the optical information recording device which forms the pit corresponding to a recording information signal in the light beam outputted from the light beam generating means, and records information on the record film currently formed on the optical information record medium It has a record location detection means to detect the record location currently recorded on an optical information record medium, and the control means which controls a light beam generating means. A control means Since the output of the light beam from a light beam generating means is controlled according to the record positional information outputted from a record location detection means, it becomes possible to control the output of a light beam according to a record location.

[0027] Moreover, according to invention according to claim 2, since the light beam which has the power level more than binary from a light beam generating means is made to output and the greatest power level of a light beam is changed at least according to record positional information in case a pit is formed, a control means becomes possible [controlling so that the greatest power level of a light beam does not exceed rated value].

[0028] Moreover, according to invention according to claim 3, since it makes adjustable [of a generating termination time] possible according to record positional information at the generating initiation time of said light beam in case a pit is formed, a control means becomes possible [controlling the generating timing of a light beam according to a record location].

[0029] According to invention according to claim 4, moreover, a control means A pit when a generate time and record positional information are smaller than a predetermined value A generating termination time is delayed predetermined time rather than a generating termination time at the generating initiation time of a recording information signal, respectively at the light beam generating initiation time. When record positional information is larger than a predetermined value Since it controls to delay a light beam generating termination time predetermined time, the generating timing of a light beam can be controlled according to a record location, and distortion of the pit by the lack of heat energy can cancel a time gap of the regenerative signal produced owing to.

[0030] Moreover, according to invention according to claim 5, since a record location detection means detects a record location based on the information included in a recording information signal, it can control the output pattern of a light beam by the easy configuration.

[0031] Moreover, according to invention according to claim 6, since a record location detection means is detected based on the information beforehand recorded on the optical information record medium, it can control the output pattern of a light beam by the easy configuration.
[0032] Moreover, since the control information for changing the output pattern of the light beam outputted from an optical information recording apparatus in the optical information record medium which records information by forming the pit corresponding to a recording information signal in the light beam outputted from the light beam generating means is recorded beforehand according to invention according to claim 7, this is realizable with a configuration with the easy equipment which carries out record playback.
[0033] Moreover, according to invention according to claim 8, it is realizable with a configuration with the easy equipment with which it carries out record playback of this since control information is a hour entry.
[0034] Moreover, according to invention according to claim 9, it is realizable with a configuration with the easy equipment with which it carries out record playback of this since control information is radius information.
[0035]
[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained, referring to a drawing.
The gestalt of operation of the 1st of gestalt this invention of the 1st operation explains the case where it records with 3 value signals mentioned above to an example.
[0036] Drawing 4 shows the example of a block configuration of 3 value signals generation circuit which outputs the light beam for record in the optical information recording apparatus of the gestalt of the 1st operation according to the inputted record data signal. In addition, since other parts of an optical information recording device can be constituted from equipment known more nearly openly than before, the illustration and explanation are omitted.
[0037] Three value signals generation circuit in drawing 4 consists of the record data signal input section 401, the record compensation means 402, the voltage-current converters 403 and 404, an adder 405, the light beam light emitting device 406, D/A converters 408 and 409, a radius detection means 410, and a control section 407 that performs control of each part. Moreover, the record compensation means 402 consists of a pattern distinction circuit 411 and an amendment pulse generator 412 further.
[0038] The pattern distinction circuit 411 generates a square wave, a part for the radical headquarters D1, i.e., the electrical-potential-difference value, of 3 value signals, according to the record data signal (information bit train) inputted from the record data signal input section 401.
[0039] The radius detection means 410 detects a record radius, and supplies it to a control section 407 by making it into record radius information.
[0040] A control section 407 supplies record radius information to the amendment pulse generator 412 while outputting the driving signal (digital signal) for obtaining the output level of the light beam according to it to D/A converters 408 and 409 based on the record radius information supplied from the radius detection means 410.
[0041] The amendment pulse generator 412 generates the square wave of the output

increment D2 of the 3 value signals, i.e., an electrical-potential-difference value, according to the record radius information supplied from the control section 407.

[0042] D/A converters 408 and 409 change into E0 and E1 of an analog signal the digital signal inputted from the control section 407, and supply it to the voltage-current converters 403 and 404, respectively.

[0043] The voltage-current converters 403 and 404 generate the electrical-potential-difference values D1 and D2 from the record compensation means 402, and the current value corresponding to the electrical-potential-difference values E0 and E1 from a control section 407, and supply them to an adder 405.

[0044] An adder 405 adds two inputted current values, and supplies them to the light beam light emitting device 406 by making an aggregate value into a drive current signal.

[0045] In addition, the relation with the wave (drawing 5) of 3 value signals outputted from D1, D2, E0, above-mentioned E1, and the above-mentioned light beam light emitting device 406 The width of face W1 of the square wave which is a part for radical headquarters, and height H1 are decided according to the pulse width of a square wave D1, and the magnitude of E0, respectively, and the width of face W2 of the square wave of output increment and height H2 are decided according to the pulse width of a square wave D2, and the magnitude of E1, respectively.

[0046] Next, the concrete actuation in 3 value signals generation circuit constituted in this way is explained using drawing 1 and drawing 2 . When recording by 3 value signals generation circuit (drawing 4) of the gestalt of this operation, drawing 1 (a) The relation between the record radius (axis of abscissa) detected with the radius detection means 410 and the power level (axis of ordinate) of the light beam output which the light beam light emitting device 406 outputs is shown. Drawing 1 (b) An example of the light beam output pattern at that time is shown, and drawing 1 (c) shows an example of the change pattern of dP at that time (difference of P1 and P0) further.

[0047] In addition, the inside P0, P1, dP, R1, and R2 of drawing 1 shall have pointed out the same thing as drawing 9 and drawing 10 toward the periphery of a record medium, so that the record radius of drawing 1 (a) goes to the right. Actuation of 3 value signals generation circuit of drawing 4 is mainly performed by control of a control section 407, and it gets down, and explains focusing on actuation of a control section 407 hereafter.

[0048] the record radius information that a control section 407 is first supplied from the radius detection means 410, and the threshold value R1 of the record radius at the time of record by 3 value signals -- comparing -- record radius information -- R1 -- smallness -- as shown in drawing 1 (c), a case asks for P1 level so that dP of drawing 1 (b), i.e., the output increment of 3 value signals, may become constant value, and supplies a predetermined electrical-potential-difference value to the voltage-current converter 404.

[0049] On the other hand, when a record radius consists of R1 size, the value of P1 of drawing 1 (b) is the threshold value Max of the light beam light emitting device 406 of operation. According to a record radius, dP is calculated so that Power may not be exceeded, and it asks for the level of P1 based on the dP value, and the electrical-potential-difference value for outputting the level to the voltage-current converter 504 is supplied.

[0050] If this example is the case where it controls to decrease linearly and this control is

performed after a record radius amounts the value of dP to R1 as shown in drawing 1 (c) As shown in the continuous line of drawing 1 (a), the power level of the output of the light beam light emitting device 406 increases as a record radius goes to a periphery, and the level of P1 is Max. Since it becomes constant value after reaching Power (record radius R1) The level of a light beam output is Max. It becomes possible to control not to exceed Power.

[0051] In addition, if the change pattern of dP fulfills not only the example shown in drawing 1 (c) but the conditions that P1 does not exceed MaxPower, it cannot be overemphasized that a pattern like drawing 2 (a) - (c) can also be applied to the gestalt of this operation. That is, when drawing 2 (a) makes dP increase to the record radius R1 linearly and it passes over R1, the pattern decreased linearly is shown. and drawing 2 (b) shows the case of the pattern which decreases dP linearly from the start to the end.

[0052] Moreover, when drawing 2 (c) makes dP constant value for R1 and a record radius exceeds R1, it is the case where dP is set to 0. If it is made such a configuration, since it will only be carrying out ON/OFF of the dP, circuitry becomes easy and there is an advantage of being cheaply realizable. however, drawing 2 (a), (b), and (c) -- any case -- an optical output -- Max Of course, it sets up so that Power may not be exceeded.

[0053] Since it constituted from a gestalt of the 1st operation so that the pattern of a light beam output could be changed corresponding to a record radius as explained above, in the former, it becomes possible to enable record of the place currently recorded only to the record radius R1 of drawing 1 to R2, and it is lost that the record range is spoiled. Moreover, it is Max about the output level of a light beam by modification of the pattern of a light beam output which was mentioned above. Since it can hold down to below Power, destruction and degradation of a light beam light emitting device can be prevented.

[0054] In addition, it sets in the gestalt of the 1st operation and a light beam output is Max. Although the configuration whose control section 407 supervises the record radius information that it was inputted from the radius detection means 410, as a means it is made not to exceed Power was shown As an option, a limiter is allotted to the output part of an adder 405 instead of using a radius detection means, and it is Max to the light beam light emitting device 406. Even if the driving signal to which the power level exceeding Power is made to output is inputted from an adder it is also possible to constitute so that the signal may be intercepted in a limiter -- certain **

[0055] That is, as shown in drawing 3 , the inner circumference section of a record medium, an inside periphery, and the periphery section are not asked, but the driving signal of a light beam is outputted, without changing the difference dP of P1 and P0 of 3 value signals, and a driving signal intercepts the signal more than predetermined limit level (for example, Max Power level) in a limiter, before being inputted into a light beam light emitting device. By making it such a configuration, since the radius detector 410 needs to become unnecessary, and equipment can be constituted cheaply and a control section 407 does not need to supervise a record radius, it leads to mitigation of the overhead which is in charge of 3 value signals generation.

[0056] Moreover, in the periphery section, when the gestalt of this operation perform CAV format record by 3 value signals, since the amount of the output increment dP of a light beam output become less and sufficient heat energy be obtain in a recording start edge.

the pit configuration form be consider that the pit configuration of distortion and a request be acquire rather than the record location R1. The actuation at the time of reproducing the pit of such a perverted configuration is explained using drawing 7 .

[0057] Drawing 7 (a) and (b) are drawings showing the playback wave when reproducing the output pattern of the light beam at the time of recording on the inner circumference section and the periphery section from R1 to the same record data signal, respectively, the configuration of the pit formed, and its pit, and the relation of the signal which made it binary with the predetermined threshold Th.

[0058] Since the pit of a desired configuration is formed in the inner circumference section from R1 so that it may understand, even if it sees drawing 7 (a), the gap with the time signal which reproduced this and made the playback wave binary as a record data signal has not been produced.

[0059] However, only dT will be delay for the rising edge of the record data signal of original [point / which be recognize that a point / which the standup of a playback wave / the modulation factor in a recording start edge be low, and / become loose when this be reproduce, since the width of face of the recording start edge of a pit be distorted / in / as showed in drawing 7 (b) / the periphery section / from R1 and it be formed, and exceed a threshold Th /, i.e., playback, side be a rising edge].

[0060] However, since linear velocity becomes quick as it goes to the periphery section in a CAV format, the die length of the pit formed becomes long and the rate that the die length of the distortion to a pit overall length occupies so much becomes low. Therefore, since the effect which the distortion gives the configuration of this pit to a regenerative signal at the time of playback becomes small, it hardly becomes a problem.

[0061] the gestalt of the 2nd operation -- it is also going to remove the effect which is shown below and which distortion of the configuration of such a pit gives the gestalt of the 2nd operation to a regenerative signal.

[0062] a different place from the gestalt of the 1st operation changes the magnitude of dP of drawing 1 , when a record radius becomes larger than the value set up beforehand -- in addition, it is the point which shifts the recording start time of a pit before an actual recording start time, and is going to amend the delay of the rising edge of the regenerative signal which a playback side recognizes by carrying out like this. In order to realize this, the gestalt of this operation has added the edge location shift means further into the configuration of the record compensation means 402 of drawing 4 mentioned above.

[0063] An example of the configuration is shown in drawing 6 (a). In addition, in drawing 6 (a), since it is the same as that of drawing 4 about the configuration of those other than a record compensation means, the illustration and explanation have been omitted. The edge location shift circuit 601 changes the time location of the rising edge of the output signal of the pattern distinction circuit 401, and a falling edge by control of a control section 407.

[0064] The actuation at the time of recording with this configuration is explained using drawing 6 R> 6 (b) and drawing 6 (c). In addition, with the gestalt of this operation, record by 3 value signals is performed and the power level of a light beam output is explained as what changes like drawing 1 (a).

[0065] The record data signal into which drawing 6 (b) and drawing 6 (c) are inputted from the record data signal input section 401, The output signal D1 and the output signal D2

from the amendment pulse generator 412 from the edge location shift circuit 601. The relation of timing with the output pattern of the light beam outputted from the light beam light emitting device 406 is shown, and the case where drawing 6 (b) performed the inner circumference section in the periphery section, and drawing 6 (c) records [1 / of drawing 1 R> 1 (a) / R] from R1 is shown.

[0066] First, a control section 407 compares with R1 the record radius detected from the radius detection means 410.

[0067] a record radius -- R1 -- smallness -- a case goes to the periphery section like drawing 1 (a) -- are alike, follow and the power level of a light beam output is made to increase. while controlling so that dP value becomes fixed, as shown in drawing 6 (b), the edge location shift circuit 601 is controlled and both the rising edge of a light beam output pattern, a falling edge, i.e., a recording start point, and the point ending [record] are delayed.

[0068] The power level of a light beam output is Max by on the other hand, changing dP according to a record radius, when a record radius consists of R1 size. While controlling not to exceed Power level, as shown in drawing 6 (c), a falling edge, i.e., the point ending [record], is delayed. That is, from R1, it controls by the inner circumference section so that only dT is delayed on the whole [the timing of the output pattern of a light beam] than a record data signal (drawing 6 (b)), and it controls by it so that only the falling edge of the output pattern of a light beam is delayed for the falling edge of a record data signal from R1 by the periphery section by only dT (drawing 6 (c)).

[0069] Consequently, when recording the same record data signal with this configuration, only in dT, that rising edge will precede [the periphery section] the output pattern of a light beam rather than the inner circumference section from R1, and, as for a falling edge, both will gather.

[0070] The signal wave form when making binary the playback wave when reproducing the configuration of the pit formed by the output pattern of this light beam and it and it with a certain threshold is explained using drawing 8 .

[0071] Drawing 8 can be set when it records to the same record data signal. It is drawing showing the playback wave when reproducing a light beam output pattern, the configuration of the pit formed, and its pit, and the relation of the signal which made it binary with the predetermined threshold Th. Drawing 8 (a) In the gestalt of this operation, each actuation when recording on the inner circumference section from R1 and drawing 8 (b) express each actuation when recording on the periphery section from R1 in the gestalt of this operation.

[0072] As shown in drawing 8 (a), the start edge of the pit formed in the inner circumference section rather than R1 with the gestalt of this operation is delayed for the rising edge of a record data signal by dT.

[0073] On the other hand, as shown in drawing 8 (b), the start edge of the pit formed in the periphery section rather than R1 is the same location as the rising edge and time amount target of a record data signal, and the termination of a pit is delayed for a falling edge by dT.

[0074] Therefore, if both are compared, as compared with the pit (drawing 8 (a)) where the pit (drawing 8 (b)) formed in the periphery section from R1 was formed in the inner

circumference section from R1, the start edge precedes only dT in time. Therefore, when the pit of the periphery section is reproduced rather than R1, the standup of a playback wave becomes loose and the predetermined threshold Th is reached at first since a modulation factor becomes low under the effect of distortion of the pit in the start edge as shown in drawing 8 (b) that is, the rising edge Hc of the signal made binary is delayed for the rising edge of a record data signal by only dT. Moreover, since falling of a playback wave becomes the termination and homotopic of a pit, as for the signal made binary, only dT is delayed for the falling edge Lc of a record data signal. That is, the signal which made the playback wave binary starts and both of a falling edge are delayed for that of a record data signal by only dT.

[0075] Moreover, since the standup of a playback wave and falling are in agreement with the start edge of a pit, and termination as it was shown in drawing 8 (a), since the pit was formed in the desired configuration when the pit of the inner circumference section is reproduced rather than R1, as for the signal made binary, both (Hb, Lb) are delayed for the standup of a record data signal, and a falling edge by only dT.

[0076] Therefore, when it records without performing the standup of a light beam output, and timing control of a failing edge Although the gap only for dT had arisen in the inner circumference section and the periphery section rather than R1 in the rising edge of the regenerative signal (signal which made the playback wave binary) from the formed pit as drawing 7 (a) and (b) showed By recording with the gestalt of this operation, from R1, the gap on the time-axis at the time of playback will be canceled also for the inner circumference section by on the whole [the periphery section] than a record data signal delaying only dT, and the wave of the signal which made the playback wave binary will be reproduced on the same conditions.

[0077] As explained above, according to the gestalt of the 2nd operation, the delay of the rising edge of the regenerative signal which a playback side recognizes by distortion of the formed pit is amended by shifting the recording start point of a pit in front in time than an actual recording start point.

[0078] A shifted part dT of an above-mentioned recording start edge and a termination edge can measure and find time amount until a playback wave exceeds a threshold Th from the rising edge of for example, a record data signal according to a record radius.

[0079] In addition, with the gestalt of the 2nd operation, although it applied case [whose change pattern of dP was / like drawing 1 (c)], it is applicable not only to this but other change patterns (drawing 2 (a), (b), (c), etc.). Since the case where dP becomes 0 suddenly in the location of the record radius R1, and it becomes impossible for a regenerative-apparatus side to be unable to follow in footsteps of the abrupt change arises like especially drawing 2 (c) in the example from which dP changes rapidly, naturally to such an example, it is very effective.

[0080] Of course, although it is possible to acquire the same effectiveness by applying the gestalt of the 2nd operation when recording by the binary signal in all inside-and-outside peripheries As shown in drawing 11 , since the rate that the part LE of the distortion to the whole pit occupies in the inner circumference section (drawing 11 (a)) is larger than the case (drawing 11 (b)) of the periphery section Since the record over the error of the generating timing of a light beam and the effect on a regenerative signal are large, there is

a case where it becomes impossible to record and reproduce correctly for the noise added from the exterior of equipment etc. at the time of record and playback. Therefore, with the gestalt of the 2nd operation, in the inner circumference section, record by 3 conventional value signals is performed, and since the above-mentioned effect of pit distortion applied the gestalt of this operation in the low periphery section, such a problem does not arise.

[0081] Moreover, in the gestalt of the 1st and the 2nd operation, although the radius detector 410 of dedication was used in order to detect a record radius, it cannot be overemphasized that it can detect even if it computes from information, such as absolute time information currently beforehand recorded on PURIGURUBU etc., address information of the signal to record, and chart lasting time.

[0082] Furthermore, in the gestalt of the 1st and the 2nd operation, by recording beforehand the control information for changing the pattern of a light beam output on the optical information record medium, the control information can be read and, of course, desired record control can be made.

[0083]

[Effect of the Invention] Since it becomes possible to control so that the greatest power level of a light beam does not exceed rated value by changing the power level of the output of a light beam according to a record radius according to this invention as the gestalt of the 1st operation described as explained above, spoiling the range in which the record in a record medium is possible is avoided. Moreover, as the gestalt of the 2nd operation described, it becomes possible to control the generating timing of a light beam according to a record radius, and distortion of the pit by the lack of heat energy can cancel a time gap of the regenerative signal produced owing to

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[Translation done.]

TECHNICAL FIELD

[Field of the Invention] This invention relates to the optical information recording device and the optical information record medium which perform informational record and elimination using the crystallized state of a recording layer changing by making a light beam condense on the recording surface of an optical information record medium.

[Translation done.]

PRIOR ART

[Description of the Prior Art] The optical information record medium which can eliminate and rewrite recording information in recent years attracts attention. For example, with the optical information record medium of a phase change mold, information recorded by recording information by changing the crystallized state of a recording layer, and detecting reflection factor change of the recording layer accompanying such a change of state by the irradiated light beam at the time of playback is reproduced among rewritable optical information record media.
[0003] As an approach of recording information on the optical information record medium in which such rewriting is possible, power level of a light beam is made binary with high level and a low level according to the information bit (1 or 0) which should be recorded, and the approach of recording by irradiating the light beam at an optical information record medium is learned.
[0004] However, by the record approach by this binary signal, in the recording start edge on a record medium, since heat energy is accumulated by operation of heat conduction as it is used as energy for a part of heat energy changed from light energy to heat a record part beforehand and results in record termination one end, the flat-surface configuration of the formed pit may turn into the so-called broad tear drop configuration (teardrop configuration) as it results in a trailer.
[0005] If the flat-surface configuration of a pit turns into a tear drop configuration, since the start edge and termination of a pit will not be formed correctly, in the optical information record medium which detects the start edge location and termination location of a pit, and reproduces a signal, a jitter (the amount of fluctuation of the start edge of the pit to a detection width of window and termination) becomes large, and an exact playback wave is no longer acquired.
[0006] For this reason, the record approach by the so-called multiple-value signal of changing the power level of a light beam irradiated in order to record information more than a three-stage is learned. This makes a record medium generate heat rapidly by giving the light beam of power level also with the high high-level twist of a binary signal at the time of a recording start, i.e., exposure initiation of a light beam, in case a pit is formed,

makes the whole heating value homogeneity by lowering the power level of a light beam in consideration of the cumulative effect of heat one by one henceforth, and is the record approach of controlling distortion of the configuration of the pit formed and aiming at an error and reduction of a jitter.

[0007] Here, the record approach by binary, three values, and the multiple-value signal is explained in detail with reference to drawing 9 . Drawing 9 shows the relation between the power level of the light beam output irradiated by the record location when record by the binary signal, 3 value signals, and the multiple-value signal is performed, the temperature distribution of the part by which the light beam was irradiated, and the pit configuration formed, respectively, and a light beam is explained as what moves toward the right from the left as the arrow head of the record direction showed to this drawing.

[0008] It is the case where it records in the binary signal of high level P0 and a low level B, and as temperature distribution showed in this drawing, as for drawing 9 (a), it turns out that the pit which serves as the form where it integrated with the wave of the power level of a light beam output, consequently is formed serves as a tear drop configuration.

[0009] Drawing 9 (b) can make the pit which it is the case where it records by 3 value signals which applied the level P1 only with dP still higher than P0, temperature goes up to the above-mentioned binary signals P0 and B rapidly at a recording start edge since the standup configuration of temperature distribution becomes steep an outputted part of dP, consequently is formed in them the configuration by which distortion by the recording start edge was amended.

[0010] Drawing 9 (c) is the case where it records in the light beam which divided the power level of a light beam output into the multistage story rather than 3 value signals of drawing 9 (b), and can be brought close to the configuration of the pit for which it asks more finely than the 3 above-mentioned value signals.

[0011] by the way -- the recording method of a record medium -- the linear velocity at the time of record -- regularity -- that is A rotational frequency changes according to the record location (a record radius is called below) in radial [of a record medium]. The format to which a rotational frequency decreases, so that it goes to a periphery (CLV format: Constant Linear Velocity format), The angular rate of rotation to the record radius of a record medium responds to regularity, and linear velocity responds to a record radius, it changes, and it is divided roughly into two of the formats (CAV format: Constant Angular Velocity format) which linear velocity increases, so that it goes to a periphery

[0012] Since linear velocity increases so that it goes in the direction of a periphery, as mentioned above when recording in a CAV format, the time amount to which the light beam is irradiating per unit area of a record part becomes short, and the heating value generated in per unit area falls. Therefore, it is necessary to make the power of a light beam increase, when recording in a CAV format as it goes to a periphery.

[0013] drawing 10 showed the relation between the record radius at the time of performing record by CAV format, taking into consideration the point mentioned above (axis of abscissa), and the power level (axis of ordinate) of the light beam output to irradiate -- it is. Among this drawing, when P1 amends distortion of a teardrop configuration by showing the high-level value of the binary signal in the case of drawing 9 (a) when P0 does not take distortion of a teardrop configuration into consideration that is,

that is, the value which added dP to P0 in the case of drawing 9 (b) is shown.

[0014] However, if a record radius shows a record-medium periphery, so that it goes to the right, and MaxPower shows the rated level (operating-limits level) of a light beam light emitting device among this drawing and the power level of a light beam output exceeds this value, degradation of a component shall be remarkable and a life shall become short. Since linear velocity increases so that it goes to the periphery section, in the CAV format, the power level P0 and P1 of a light beam is also high in connection with it at the time of record, so that it may understand, even if it sees this drawing.

[0015] Therefore, when recording towards the periphery section from the inner circumference section in the binary signal of only the power level of P0, a light beam output is Max. It can be called the limitation which can record the radius location R2 which reaches Power. However, if it records similarly [in the light beam of the multiple-value signal containing the power level of P1], when it comes to R1 located in an inner circumference side rather than it before going to R2, MaxPower will be reached and the recordable range will narrow. That is, if it records by the multiple-value signal in order to control distortion of the pit of a teardrop configuration, the record radius corresponding to the rated value of a light beam light emitting device will become short, and a result by which the record range is spoiled will be brought.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] Since it becomes possible to control so that the greatest power level of a light beam does not exceed rated value by changing the power level of the output of a light beam according to a record radius according to this invention as the gestalt of the 1st operation described as explained above, spoiling the range in which the record in a record medium is possible is avoided. Moreover, as the gestalt of the 2nd operation described, it becomes possible to control the generating timing of a light beam according to a record radius, and distortion of the pit by the lack of heat energy can cancel a time gap of the regenerative signal produced owing to.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] The place which it is made in order that this invention may solve such a problem, and is made into the purpose is to offer the optical information recording device which controls that the pit further formed in the teardrop configuration has a bad influence on playback, without spoiling the record range, in case CAV format record is performed.

[Translation done.]

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damages caused by the use of this translation.
1.This document has been translated by computer. So the translation may not reflect the original precisely.
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MEANS

[Means for Solving the Problem] It is what was considered in order that this invention might solve the above technical problems. An optical-recording-medium recording device according to claim 1 Moving relatively an optical information record medium and the optical head which has a light beam generating means In the optical information recording device which forms the pit corresponding to a recording information signal in the light beam outputted from the light beam generating means, and records information on the record film currently formed on the optical information record medium It has a record location detection means to detect the record location currently recorded on an optical information record medium, and the control means which controls a light beam generating means, and a control means is characterized by to control the output of the light beam from a light beam generating means according to the record positional information

outputted from a record location detection means.
[0018] Moreover, invention according to claim 2 is invention according to claim 1, and in case a control means forms a pit, it makes the light beam which has the power level more than binary from a light beam generating means output, and changes the greatest power level of a light beam at least according to record positional information.
[0019] Moreover, invention according to claim 3 is invention according to claim 2, and in case a control means forms a pit, it makes adjustable [of a generating termination time] possible according to record positional information at the generating initiation time of said light beam.
[0020] Invention according to claim 4 is any one invention of claim 1 thru/or claim 3. Moreover, a control means In case a pit is formed, when record positional information is smaller than a predetermined value At the light beam generating initiation time, a generating termination time is delayed predetermined time rather than a generating termination time at the generating initiation time of a recording information signal, respectively, and when record positional information is larger than a predetermined value, it controls to delay a light beam generating termination time predetermined time.
[0021] Moreover, invention according to claim 5 is any one invention of claim 1 thru/or claim 4, and a record location detection means detects a record location based on the information included in a recording information signal.
[0022] Moreover, invention according to claim 6 is any one invention of claim 1 thru/or claim 4, and a record location detection means is detected based on the information beforehand recorded on the optical information record medium.
[0023] Moreover, when invention according to claim 7 forms the pit corresponding to a recording information signal in the light beam outputted from the light beam generating means, in the optical information record medium which records information, the control information for changing the light beam output from an optical information recording apparatus is recorded beforehand.
[0024] Moreover, invention according to claim 8 is invention according to claim 7, and control information is a hour entry.
[0025] Moreover, invention according to claim 9 is invention according to claim 7, and control information is positional information.

[Translation done.]

OPERATION

[Function] Moving relatively an optical information record medium and the optical head which has a light beam generating means according to invention according to claim 1 In the optical information recording device which forms the pit corresponding to a recording information signal in the light beam outputted from the light beam generating means, and records information on the record film currently formed on the optical information record medium It has a record location detection means to detect the record location currently recorded on an optical information record medium, and the control means which controls a light beam generating means. A control means Since the output of the light beam from a light beam generating means is controlled according to the record positional information outputted from a record location detection means, it becomes possible to control the output of a light beam according to a record location.

[0027] Moreover, according to invention according to claim 2, since the light beam which has the power level more than binary from a light beam generating means is made to output and the greatest power level of a light beam is changed at least according to record positional information in case a pit is formed, a control means becomes possible [controlling so that the greatest power level of a light beam does not exceed rated value].

[0028] Moreover, according to invention according to claim 3, since it makes adjustable [of a generating termination time] possible according to record positional information at the generating initiation time of said light beam in case a pit is formed, a control means becomes possible [controlling the generating timing of a light beam according to a record location].

[0029] According to invention according to claim 4, moreover, a control means A pit when a generate time and record positional information are smaller than a predetermined value A generating termination time is delayed predetermined time rather than a generating termination time at the generating initiation time of a recording information signal, respectively at the light beam generating initiation time. When record positional information is larger than a predetermined value Since it controls to delay a light beam generating termination time predetermined time, the generating timing of a light beam can be controlled according to a record location, and distortion of the pit by the lack of heat energy can cancel a time gap of the regenerative signal produced owing to.

[0030] Moreover, according to invention according to claim 5, since a record location detection means detects a record location based on the information included in a recording information signal, it can control the output pattern of a light beam by the easy configuration.

[0031] Moreover, according to invention according to claim 6, since a record location detection means is detected based on the information beforehand recorded on the optical information record medium, it can control the output pattern of a light beam by the easy configuration.

[0032] Moreover, since the control information for changing the output pattern of the light beam outputted from an optical information recording apparatus in the optical information record medium which records information by forming the pit corresponding to a recording

information signal in the light beam outputted from the light beam generating means is recorded beforehand according to invention according to claim 7, this is realizable with a configuration with the easy equipment which carries out record playback.

[0033] Moreover, according to invention according to claim 8, it is realizable with a configuration with the easy equipment with which it carries out record playback of this since control information is a hour entry.

[0034] Moreover, according to invention according to claim 9, it is realizable with a configuration with the easy equipment with which it carries out record playback of this since control information is radius information.

[0035]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained, referring to a drawing.

The gestalt of operation of the 1st of gestalt this invention of the 1st operation explains the case where it records with 3 value signals mentioned above to an example.

[0036] Drawing 4 shows the example of a block configuration of 3 value signals generation circuit which outputs the light beam for record in the optical information recording apparatus of the gestalt of the 1st operation according to the inputted record data signal. In addition, since other parts of an optical information recording device can be constituted from equipment known more nearly openly than before, the illustration and explanation are omitted.

[0037] Three value signals generation circuit in drawing 4 consists of the record data signal input section 401, the record compensation means 402, the voltage-current converters 403 and 404, an adder 405, the light beam light emitting device 406, D/A converters 408 and 409, a radius detection means 410, and a control section 407 that performs control of each part. Moreover, the record compensation means 402 consists of a pattern distinction circuit 411 and an amendment pulse generator 412 further.

[0038] The pattern distinction circuit 411 generates a square wave, a part for the radical headquarters D1, i.e., the electrical-potential-difference value, of 3 value signals, according to the record data signal (information bit train) inputted from the record data signal input section 401.

[0039] The radius detection means 410 detects a record radius, and supplies it to a control section 407 by making it into record radius information.

[0040] A control section 407 supplies record radius information to the amendment pulse generator 412 while outputting the driving signal (digital signal) for obtaining the output level of the light beam according to it to D/A converters 408 and 409 based on the record radius information supplied from the radius detection means 410.

[0041] The amendment pulse generator 412 generates the square wave of the output increment D2 of the 3 value signals, i.e., an electrical-potential-difference value, according to the record radius information supplied from the control section 407.

[0042] D/A converters 408 and 409 change into E0 and E1 of an analog signal the digital signal inputted from the control section 407, and supply it to the voltage-current converters 403 and 404, respectively.

[0043] The voltage-current converters 403 and 404 generate the electrical-potential-difference values D1 and D2 from the record compensation means 402, and the current

value corresponding to the electrical-potential-difference values E0 and E1 from a control section 407, and supply them to an adder 405.

[0044] An adder 405 adds two inputted current values, and supplies them to the light beam light emitting device 406 by making an aggregate value into a drive current signal.

[0045] In addition, the relation with the wave (drawing 5) of 3 value signals outputted from D1, D2, E0, above-mentioned E1, and the above-mentioned light beam light emitting device 406 The width of face W1 of the square wave which is a part for radical headquarters, and height H1 are decided according to the pulse width of a square wave D1, and the magnitude of E0, respectively, and the width of face W2 of the square wave of output increment and height H2 are decided according to the pulse width of a square wave D2, and the magnitude of E1, respectively.

[0046] Next, the concrete actuation in 3 value signals generation circuit constituted in this way is explained using drawing 1 and drawing 2 . When recording by 3 value signals generation circuit (drawing 4) of the gestalt of this operation, drawing 1 (a) The relation between the record radius (axis of abscissa) detected with the radius detection means 410 and the power level (axis of ordinate) of the light beam output which the light beam light emitting device 406 outputs is shown. Drawing 1 (b) An example of the light beam output pattern at that time is shown, and drawing 1 (c) shows an example of the change pattern of dP at that time (difference of P1 and P0) further.

[0047] In addition, the inside P0, P1, dP, R1, and R2 of drawing 1 shall have pointed out the same thing as drawing 9 and drawing 10 toward the periphery of a record medium, so that the record radius of drawing 1 (a) goes to the right. Actuation of 3 value signals generation circuit of drawing 4 is mainly performed by control of a control section 407, and it gets down, and explains focusing on actuation of a control section 407 hereafter.

[0048] the record radius information that a control section 407 is first supplied from the radius detection means 410, and the threshold value R1 of the record radius at the time of record by 3 value signals -- comparing -- record radius information -- R1 -- smallness -- as shown in drawing 1 (c), a case asks for P1 level so that dP of drawing 1 (b), i.e., the output increment of 3 value signals, may become constant value, and supplies a predetermined electrical-potential-difference value to the voltage-current converter 404.

[0049] On the other hand, when a record radius consists of R1 size, the value of P1 of drawing 1 (b) is the threshold value Max of the light beam light emitting device 406 of operation. According to a record radius, dP is calculated so that Power may not be exceeded, and it asks for the level of P1 based on the dP value, and the electrical-potential-difference value for outputting the level to the voltage-current converter 504 is supplied.

[0050] If this example is the case where it controls to decrease linearly and this control is performed after a record radius amounts the value of dP to R1 as shown in drawing 1 (c) As shown in the continuous line of drawing 1 (a), the power level of the output of the light beam light emitting device 406 increases as a record radius goes to a periphery, and the level of P1 is Max. Since it becomes constant value after reaching Power (record radius R1) The level of a light beam output is Max. It becomes possible to control not to exceed Power.

[0051] In addition, if the change pattern of dP fulfills not only the example shown in

drawing 1 (c) but the conditions that P1 does not exceed MaxPower, it cannot be overemphasized that a pattern like drawing 2 (a) - (c) can also be applied to the gestalt of this operation. That is, when drawing 2 (a) makes dP increase to the record radius R1 linearly and it passes over R1, the pattern decreased linearly is shown, and drawing 2 (b) shows the case of the pattern which decreases dP linearly from the start to the end.
[0052] Moreover, when drawing 2 (c) makes dP constant value for R1 and a record radius exceeds R1, it is the case where dP is set to 0. If it is made such a configuration, since it will only be carrying out ON/OFF of the dP, circuitry becomes easy and there is an advantage of being cheaply realizable. however, drawing 2 (a), (b), and (c) -- any case -- an optical output -- Max Of course, it sets up so that Power may not be exceeded.
[0053] Since it constituted from a gestalt of the 1st operation so that the pattern of a light beam output could be changed corresponding to a record radius as explained above, in the former, it becomes possible to enable record of the place currently recorded only to the record radius R1 of drawing 1 to R2, and it is lost that the record range is spoiled. Moreover, it is Max about the output level of a light beam by modification of the pattern of a light beam output which was mentioned above. Since it can hold down to below Power, destruction and degradation of a light beam light emitting device can be prevented.
[0054] In addition, it sets in the gestalt of the 1st operation and a light beam output is Max. Although the configuration whose control section 407 supervises the record radius information that it was inputted from the radius detection means 410, as a means it is made not to exceed Power was shown As an option, a limiter is allotted to the output part of an adder 405 instead of using a radius detection means, and it is Max to the light beam light emitting device 406. Even if the driving signal to which the power level exceeding Power is made to output is inputted from an adder it is also possible to constitute so that the signal may be intercepted in a limiter -- certain **
[0055] That is, as shown in drawing 3 , the inner circumference section of a record medium, an inside periphery, and the periphery section are not asked, but the driving signal of a light beam is outputted, without changing the difference dP of P1 and P0 of 3 value signals, and a driving signal intercepts the signal more than predetermined limit level (for example, Max Power level) in a limiter, before being inputted into a light beam light emitting device. By making it such a configuration, since the radius detector 410 needs to become unnecessary, and equipment can be constituted cheaply and a control section 407 does not need to supervise a record radius, it leads to mitigation of the overhead which is in charge of 3 value signals generation.
[0056] Moreover, in the periphery section, when the gestalt of this operation perform CAV format record by 3 value signals, since the amount of the output increment dP of a light beam output become less and sufficient heat energy be obtain in a recording start edge, the pit configuration form be consider that the pit configuration of distortion and a request be acquire rather than the record location R1. The actuation at the time of reproducing the pit of such a perverted configuration is explained using drawing 7 .
[0057] Drawing 7 (a) and (b) are drawings showing the playback wave when reproducing the output pattern of the light beam at the time of recording on the inner circumference section and the periphery section from R1 to the same record data signal, respectively, the configuration of the pit formed, and its pit, and the relation of the signal which made it

binary with the predetermined threshold Th.

[0058] Since the pit of a desired configuration is formed in the inner circumference section from R1 so that it may understand, even if it sees drawing 7 (a), the gap with the time signal which reproduced this and made the playback wave binary as a record data signal has not been produced.

[0059] However, only dT will be delay for the rising edge of the record data signal of original [point / which be recognize that a point / which the standup of a playback wave / the modulation factor in a recording start edge be low, and / become loose when this be reproduce, since the width of face of the recording start edge of a pit be distorted / in / as showed in drawing 7 (b) / the periphery section / from R1 and it be formed, and exceed a threshold Th /, i.e., playback, side be a rising edge].

[0060] However, since linear velocity becomes quick as it goes to the periphery section in a CAV format, the die length of the pit formed becomes long and the rate that the die length of the distortion to a pit overall length occupies so much becomes low. Therefore, since the effect which the distortion gives the configuration of this pit to a regenerative signal at the time of playback becomes small, it hardly becomes a problem.

[0061] the gestalt of the 2nd operation -- it is also going to remove the effect which is shown below and which distortion of the configuration of such a pit gives the gestalt of the 2nd operation to a regenerative signal.

[0062] a different place from the gestalt of the 1st operation changes the magnitude of dP of drawing 1 , when a record radius becomes larger than the value set up beforehand -- in addition, it is the point which shifts the recording start time of a pit before an actual recording start time, and is going to amend the delay of the rising edge of the regenerative signal which a playback side recognizes by carrying out like this. In order to realize this, the gestalt of this operation has added the edge location shift means further into the configuration of the record compensation means 402 of drawing 4 mentioned above.

[0063] An example of the configuration is shown in drawing 6 (a). In addition, in drawing 6 (a), since it is the same as that of drawing 4 about the configuration of those other than a record compensation means, the illustration and explanation have been omitted. The edge location shift circuit 601 changes the time location of the rising edge of the output signal of the pattern distinction circuit 401, and a falling edge by control of a control section 407.

[0064] The actuation at the time of recording with this configuration is explained using drawing 6 R> 6 (b) and drawing 6 (c). In addition, with the gestalt of this operation, record by 3 value signals is performed and the power level of a light beam output is explained as what changes like drawing 1 (a).

[0065] The record data signal into which drawing 6 (b) and drawing 6 (c) are inputted from the record data signal input section 401. The output signal D1 and the output signal D2 from the amendment pulse generator 412 from the edge location shift circuit 601. The relation of timing with the output pattern of the light beam outputted from the light beam light emitting device 406 is shown, and the case where drawing 6 (b) performed the inner circumference section in the periphery section, and drawing 6 (c) records [1 / of drawing 1 R> 1 (a) / R] from R1 is shown.

[0066] First, a control section 407 compares with R1 the record radius detected from the radius detection means 410.

[0067] a record radius -- R1 -- smallness -- a case goes to the periphery section like drawing 1 (a) -- are alike, follow and the power level of a light beam output is made to increase, while controlling so that dP value becomes fixed, as shown in drawing 6 (b), the edge location shift circuit 601 is controlled and both the rising edge of a light beam output pattern, a falling edge, i.e., a recording start point, and the point ending [record] are delayed.

[0068] The power level of a light beam output is Max by on the other hand, changing dP according to a record radius, when a record radius consists of R1 size. While controlling not to exceed Power level, as shown in drawing 6 (c), a falling edge, i.e., the point ending [record], is delayed. That is, from R1, it controls by the inner circumference section so that only dT is delayed on the whole [the timing of the output pattern of a light beam] than a record data signal (drawing 6 (b)), and it controls by it so that only the falling edge of the output pattern of a light beam is delayed for the falling edge of a record data signal from R1 by the periphery section by only dT (drawing 6 (c)).

[0069] Consequently, when recording the same record data signal with this configuration, only in dT, that rising edge will precede [the periphery section] the output pattern of a light beam rather than the inner circumference section from R1, and, as for a falling edge, both will gather.

[0070] The signal wave form when making binary the playback wave when reproducing the configuration of the pit formed by the output pattern of this light beam and it and it with a certain threshold is explained using drawing 8 .

[0071] Drawing 8 can be set when it records to the same record data signal. It is drawing showing the playback wave when reproducing a light beam output pattern, the configuration of the pit formed, and its pit, and the relation of the signal which made it binary with the predetermined threshold Th. Drawing 8 (a) In the gestalt of this operation, each actuation when recording on the inner circumference section from R1 and drawing 8 (b) express each actuation when recording on the periphery section from R1 in the gestalt of this operation.

[0072] As shown in drawing 8 (a), the start edge of the pit formed in the inner circumference section rather than R1 with the gestalt of this operation is delayed for the rising edge of a record data signal by dT.

[0073] On the other hand, as shown in drawing 8 (b), the start edge of the pit formed in the periphery section rather than R1 is the same location as the rising edge and time amount target of a record data signal, and the termination of a pit is delayed for a falling edge by dT.

[0074] Therefore, if both are compared, as compared with the pit (drawing 8 (a)) where the pit (drawing 8 (b)) formed in the periphery section from R1 was formed in the inner circumference section from R1, the start edge precedes only dT in time. Therefore, when the pit of the periphery section is reproduced rather than R1, the standup of a playback wave becomes loose and the predetermined threshold Th is reached at first since a modulation factor becomes low under the effect of distortion of the pit in the start edge as shown in drawing 8 (b) that is, the rising edge Hc of the signal made binary is delayed for the rising edge of a record data signal by only dT. Moreover, since falling of a playback wave becomes the termination and homotopic of a pit, as for the signal made binary, only

dT is delayed for the falling edge Lc of a record data signal. That is, the signal which made the playback wave binary starts and both of a falling edge are delayed for that of a record data signal by only dT.

[0075] Moreover, since the standup of a playback wave and falling are in agreement with the start edge of a pit, and termination as it was shown in drawing 8 (a), since the pit was formed in the desired configuration when the pit of the inner circumference section is reproduced rather than R1, as for the signal made binary, both (Hb, Lb) are delayed for the standup of a record data signal, and a falling edge by only dT.

[0076] Therefore, when it records without performing the standup of a light beam output, and timing control of a falling edge Although the gap only for dT had arisen in the inner circumference section and the periphery section rather than R1 in the rising edge of the regenerative signal (signal which made the playback wave binary) from the formed pit as drawing 7 (a) and (b) showed By recording with the gestalt of this operation, from R1, the gap on the time-axis at the time of playback will be canceled also for the inner circumference section by on the whole [the periphery section] than a record data signal delaying only dT, and the wave of the signal which made the playback wave binary will be reproduced on the same conditions.

[0077] As explained above, according to the gestalt of the 2nd operation, the delay of the rising edge of the regenerative signal which a playback side recognizes by distortion of the formed pit is amended by shifting the recording start point of a pit in front in time than an actual recording start point.

[0078] A shifted part dT of an above-mentioned recording start edge and a termination edge can measure and find time amount until a playback wave exceeds a threshold Th from the rising edge of for example, a record data signal according to a record radius.

[0079] In addition, with the gestalt of the 2nd operation, although it applied case [whose change pattern of dP was / like drawing 1 (c)], it is applicable not only to this but other change patterns (drawing 2 (a), (b), (c), etc.). Since the case where dP becomes 0 suddenly in the location of the record radius R1, and it becomes impossible for a regenerative-apparatus side to be unable to follow in footsteps of the abrupt change arises like especially drawing 2 (c) in the example from which dP changes rapidly, naturally to such an example, it is very effective.

[0080] Of course, although it is possible to acquire the same effectiveness by applying the gestalt of the 2nd operation when recording by the binary signal in all inside-and-outside peripheries As shown in drawing 11 , since the rate that the part LE of the distortion to the whole pit occupies in the inner circumference section (drawing 11 (a)) is larger than the case (drawing 11 (b)) of the periphery section Since the record over the error of the generating timing of a light beam and the effect on a regenerative signal are large, there is a case where it becomes impossible to record and reproduce correctly for the noise added from the exterior of equipment etc. at the time of record and playback. Therefore, with the gestalt of the 2nd operation, in the inner circumference section, record by 3 conventional value signals is performed, and since the above-mentioned effect of pit distortion applied the gestalt of this operation in the low periphery section, such a problem does not arise.

[0081] Moreover, in the gestalt of the 1st and the 2nd operation, although the radius

detector 410 of dedication was used in order to detect a record radius, it cannot be overemphasized that it can detect even if it computes from information, such as absolute time information currently beforehand recorded on PURIGURUBU etc., address information of the signal to record, and chart lasting time.

[0082] Furthermore, in the gestalt of the 1st and the 2nd operation, by recording beforehand the control information for changing the pattern of a light beam output on the optical information record medium, the control information can be read and, of course, desired record control can be made.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is drawing showing the relation of the output level of the light beam of an optical information recording apparatus and record radius in the gestalt of operation of the 1st of this invention.

[Drawing 2] It is drawing showing the change to the record radius of the light beam output of the optical information recording apparatus in the gestalt of operation of the 1st of this invention.

[Drawing 3] It is drawing showing actuation of the output level of the light beam of the optical information recording apparatus in the gestalt of operation of the 1st of this invention.

[Drawing 4] It is drawing showing an example of the optical information recording device in the gestalt of operation of the 1st of this invention.

[Drawing 5] It is drawing showing an example of the output pattern of the light beam of the optical information recording apparatus in the gestalt of operation of the 1st of this invention.

[Drawing 6] It is drawing showing an example and its light beam output pattern of the optical information recording apparatus in the gestalt of operation of the 2nd of this invention.

[Drawing 7] It is drawing showing actuation of the optical information recording device in the gestalt of operation of the 2nd of this invention.

[Drawing 8] It is drawing showing actuation of the conventional optical information

recording device.

[Drawing 9] It is drawing showing actuation of the conventional optical information recording device.

[Drawing 10] It is drawing showing actuation of the gestalt of operation of the 2nd of this invention.

[Drawing 11] In the gestalt of operation of the 2nd of this invention, it is drawing showing the configuration of the pit formed in a record medium.

[Description of Notations]

401 ...... Record data signal input section

402 ...... Record compensation means

403 404 ... Voltage-current converter

405 ...... Adder

406 ...... Light beam light emitting device

407 ...... Control section

408 409 ... D/A converter

410 ...... Radius detection means

411 .. .... Pattern distinction circuit

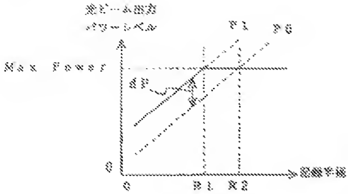
601 ...... Edge location shift circuit

[Translation done.]

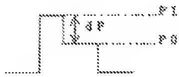
DRAWINGS

[Drawing 1]

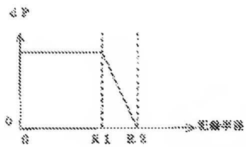
(a)



(b)

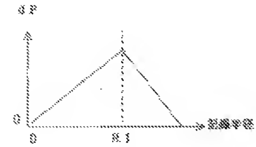


(c)

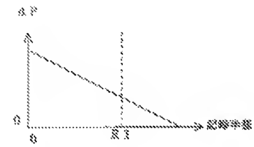


[Drawing 2]

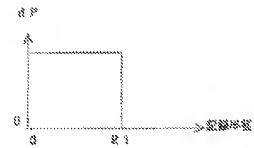
(a)



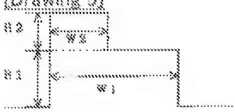
(b)



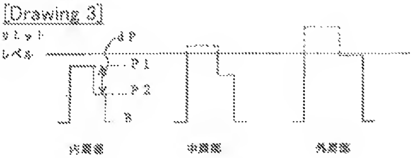
(c)



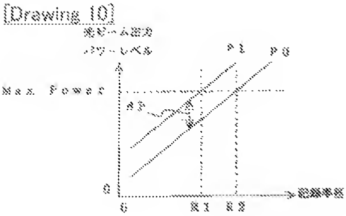
[Drawing 5]



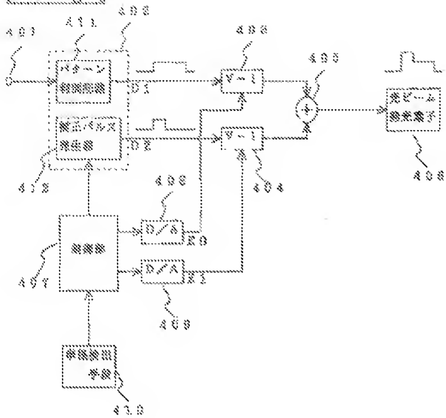
[Drawing 3]



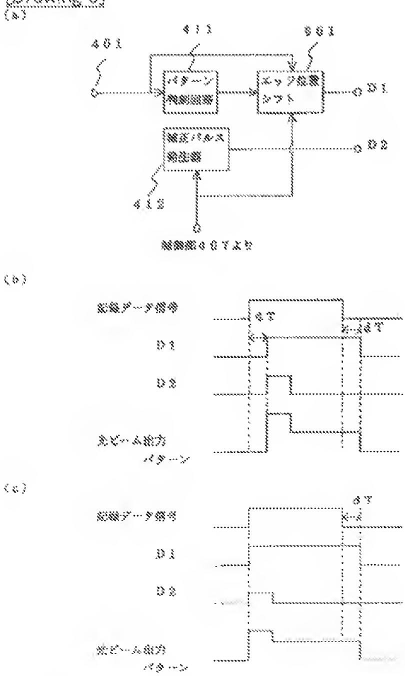
[Drawing 10]



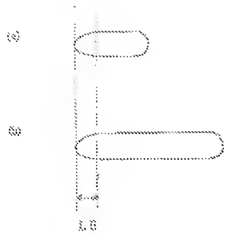
[Drawing 4]



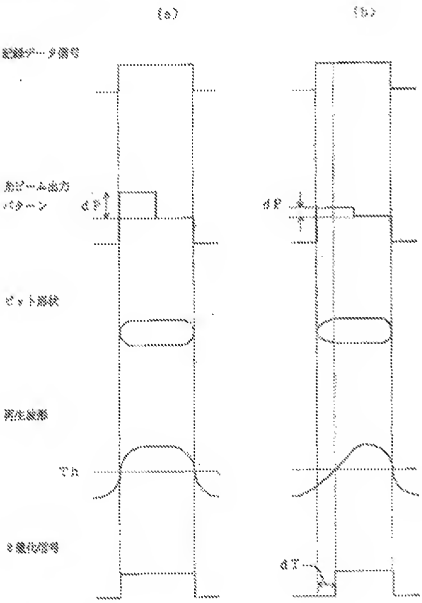
[Drawing 6]



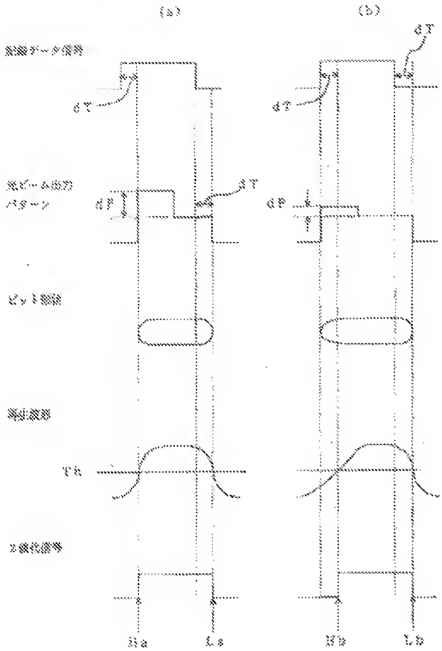
[Drawing 11]



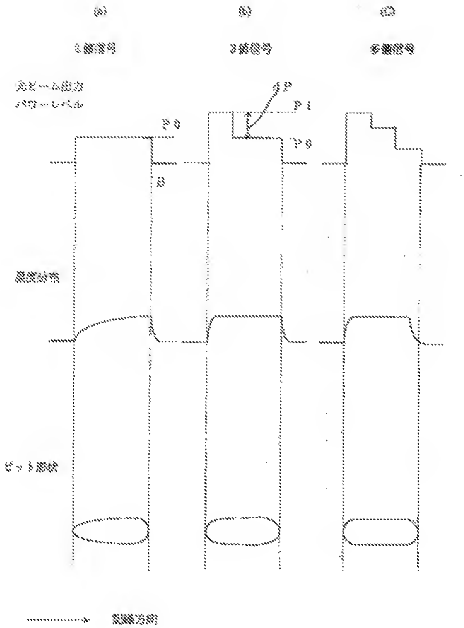
[Drawing 7]



[Drawing 8]



[Drawing 9]



[Translation done.]

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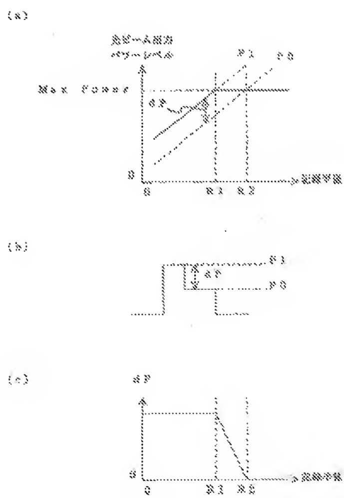
(71)出願人　000005016
パイオニア株式会社
東京都目黒区目黒1丁目4番1号

(72)発明者　栗林　祐基
埼玉県鶴ヶ島市富士見6丁目1番1号　パイオニア株式会社総合研究所内

(54)【発明の名称】光情報記録装置及び光情報記録媒体

(57)【要約】
【課題】　CAVフォーマット記録を行う際に、記録範囲を損なうことなく、さらにティアドロップ形状に形成されたピットが再生に悪影響を及ぼすことを抑制する光情報記録装置を提供するものである。
【解決手段】　光情報記録媒体と光ビーム発生手段を有する光学ヘッドとを相対的に移動しつつ、光情報記録媒体上に形成されている記録線上に、光ビーム発生手段から出力された光ビームにて記録情報信号に対応するピットを形成して情報を記録する光情報記録装置において、光情報記録媒体上に記録している記録位置を検出する記録位置検出手段と、光ビーム発生手段を制御する制御手段とを有し、制御手段は、記録位置検出手段より出力される記録位置情報に応じて、光ビーム発生手段からの光ビームの出力を制御することを特徴とする光情報記録装置。



【特許請求の範囲】

【請求項1】　光情報記録媒体と光ビーム発生手段を有する光学ヘッドとを相対的に移動しつつ、光情報記録媒体上に形成されている記録膜上に、光ビーム発生手段から出力された光ビームにて記録情報信号に対応するピットを形成して情報を記録する光情報記録装置において、前記光情報記録媒体上に記録している記録位置を検出する記録位置検出手段と、前記光ビーム発生手段を制御する制御手段とを有し、
前記制御手段は、前記記録位置検出手段より出力される記録位置情報に応じて、前記光ビーム発生手段からの光ビームの出力を制御することを特徴とする光情報記録装置。

【請求項2】　前記制御手段は、ピットを形成する際、前記光ビーム発生手段から2値以上のパワーレベルをもつ光ビームを出力させ、前記記録位置情報に応じて光ビームの少なくとも最大のパワーレベルを変化させることを特徴とする請求項1記載の光情報記録装置。

【請求項3】　前記制御手段は、ピットを形成する際、前記記録位置情報に応じて前記光ビームの発生開始時点、発生終了時点を可変可能とすることを特徴とする請求項1、または請求項2記載の光情報記録装置。

【請求項4】　前記制御手段は、ピットを形成する際、前記記録位置情報が所定の値よりも小さいときは、前記光ビーム発生開始時点、発生終了時点を、それぞれ前記記録情報信号の発生開始時点、発生終了時点よりも所定時間遅らせ、前記記録位置情報が所定の値よりも大きいときは、前記光ビーム発生終了時点を所定時間遅らせるように制御することを特徴とする請求項1、または請求項2、または請求項3記載の光情報記録装置。

【請求項5】　前記記録位置検出手段は、前記記録情報信号に含まれる情報に基づいて記録位置を検出することを特徴とする請求項1、または請求項2、または請求項3、または請求項4記載の光情報記録装置。

【請求項6】　前記記録位置検出手段は、前記光情報記録媒体に予め記録された情報に基づいて記録位置を検出することを特徴とする請求項1、または請求項2、または請求項3、または請求項4記載の光情報記録装置。

【請求項7】　光ビーム発生手段から出力された光ビームにて記録情報信号に対応するピットを形成することにより情報を記録する光情報記録媒体において、光情報記録装置からの光ビーム出力を変化させるための制御情報が予め記録されていることを特徴とする光情報記録媒体。

【請求項8】　前記制御情報が、時間情報であることを特徴とする請求項7記載の光情報記録媒体。

【請求項9】　前記制御情報が、位置情報であることを特徴とする請求項7記載の光情報記録媒体。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、光ビームを光情報記録媒体の記録面上に集光させることで記録層の結晶状態が変化することを利用して、情報の記録、消去を行う光情報記録装置及び光情報記録媒体に関する。

【0002】

【従来の技術】近年、記録情報を消去して書き換えることが可能な光情報記録媒体が注目されている。例えば、書き換え可能な光情報記録媒体のうち相変化型の光情報記録媒体では、照射された光ビームにより、記録層の結晶状態を変化させることで情報の記録を行い、再生時にこのような状態変化に伴う記録層の反射率変化を検出することで記録された情報の再生を行う。

【0003】このような書き換え可能な光情報記録媒体に情報を記録する方法としては、記録すべき情報ビット（1または0）に応じて、光ビームのパワーレベルをハイレベルとローレベルとで2値化し、その光ビームを光情報記録媒体に照射することにより記録する方法が知られている。

【0004】しかし、この2値信号による記録方法では、記録媒体上の記録開始端では光エネルギーから変換された熱エネルギーの一部が記録部分を予熱するためのエネルギーとして使われ、記録終了端側に至るに従って熱伝導の作用により熱エネルギーが蓄積されるため、形成されたピットの平面形状が終端部に至るに従って幅広の、いわゆる涙滴形状（ティアドロップ形状）になることがある。

【0005】ピットの平面形状が涙滴形状になると、ピットの始端及び終端が正確に形成されないために、ピットの始端位置及び終端位置を検出して信号を再生する光情報記録媒体においては、ジッタ（検出窓幅に対するピットの始端、終端の変動量）が大きくなり正確な再生波形が得られなくなる。

【0006】このため、情報を記録するために照射する光ビームのパワーレベルを、3段階以上に変化させる、いわゆる多値信号による記録方法が知られている。これは、ピットを形成する際、記録開始時、つまり光ビームの照射開始時に2値信号のハイレベルよりも高いパワーレベルの光ビームを与えることで急激に記録媒体を発熱させ、以降は順次、熱の蓄積効果を考慮して光ビームのパワーレベルを下げることにより全体の熱量を均一にして、形成されるピットの形状の歪みを抑制し、エラー及びジッタの減少をはかる記録方法である。

【0007】ここで、2値、3値及び多値信号による記録方法を図9を参照して詳しく説明する。図9は、2値信号、3値信号、多値信号による記録を行った場合に、記録位置に照射される光ビーム出力のパワーレベルと、光ビームが照射された部分の温度分布と、形成されるピット形状との関係をそれぞれ示したものであり、光ビームは同図に記録方向の矢印で示したように左から右方向に向かって移動するものとして説明する。

【０００８】図９（ａ）は、ハイレベルＰ０とローレベルＢの２値信号にて記録した場合であり、温度分布が同図に示した如く、光ビーム出力のパワーレベルの波形を積分したような形となり、その結果、形成されるピットは涙滴形状となってしまっていることがわかる。

【０００９】図９（ｂ）は、前述の２値信号Ｐ０、Ｂに、さらにＰ０よりｄＰだけ高いレベルＰ１を加えた３値信号にて記録を行った場合であり、温度分布の立ち上がり形状がｄＰの出力分だけ急峻になるため、温度が記録開始端で急激に上がり、その結果、形成されるピットは記録開始端での歪みが補正された形状にすることができる。

【００１０】図９（ｃ）は、図９（ｂ）の３値信号よりも光ビーム出力のパワーレベルを多段階に分けた光ビームにて記録を行った場合であり，前述の３値信号よりも細かく所望するピットの形状に近づけることができる。

【００１１】ところで、記録媒体の記録方式には、記録時の線速度が一定、即ち、回転数が記録媒体の半径方向における記録位置（以下記録半径と称する）に応じて変化し、外周へ行くほど回転数が減少するフォーマット（ＣＬＶフォーマット：Ｃｏｎｓｔａｎｔ　Ｌｉｎｅａｒ　Ｖｅｌｏｃｉｔｙフォーマット）と、記録媒体の記録半径に対する回転角速度が一定、即ち、線速度が記録半径に応じて変化し，外周へ行くほど線速度が増加するフォーマット（ＣＡＶフォーマット：Ｃｏｎｓｔａｎｔ　Ａｎｇｕｌａｒ　Ｖｅｌｏｃｉｔｙフォーマット）の２つに大別される。

【００１２】ＣＡＶフォーマットにて記録を行う場合は、前述したように外周方向へ行くほど線速度が増加するため、光ビームが記録部分の単位面積当たりに照射している時間が短くなり、単位面積当たりに発生する熱量が低下する。よって、ＣＡＶフォーマットにて記録を行う場合は、光ビームのパワーを外周へ向かうにしたがって増加させる必要がある。

【００１３】図１０は、上述した点を考慮に入れてＣＡＶフォーマットによる記録を行う際の、記録半径（横軸）と照射する光ビーム出力のパワーレベル（縦軸）との関係を示したものある。同図中，Ｐ０はティアドロップ形状の歪みを考慮しない場合、つまり図９（ａ）の場合の２値信号のハイレベル値を示し，Ｐ１はティアドロップ形状の歪みを補正する場合、つまり図９（ｂ）の場合のＰ０にｄＰを上乗せした値を示す。

【００１４】ただし、同図中、記録半径は右にいくほど記録媒体外周を示し，また，ＭａｘＰｏｗｅｒは光ビーム発光素子の定格レベル（動作限界レベル）を示し，光ビーム出力のパワーレベルがこの値を超えると素子の劣化が著しく、寿命が短くなるものとする。同図を見ても分かるように、ＣＡＶフォーマットでは外周部へ行くほど線速度が増加するため、記録時には光ビームのパワーレベルＰ０，Ｐ１もそれに伴い高くなっている。

【００１５】従って、Ｐ０のパワーレベルのみの２値信号にて内周部から外周部に向けて記録を行うときは、光ビーム出力がＭａｘ　Ｐｏｗｅｒに達する半径位置Ｒ２が記録できる限界といえる。しかし、Ｐ１のパワーレベルをも含んだ多値信号の光ビームにて同様に記録を行うと、Ｒ２に行く前にそれよりも内周側に位置するＲ１に来たときにＭａｘＰｏｗｅｒに達してしまい記録可能な範囲が狭まってしまう。即ち、ティアドロップ形状のピットの歪みを抑制するために多値信号にて記録を行うと，光ビーム発光素子の定格値に対応する記録半径が短くなり、記録範囲が損なわれる結果となる。

【００１６】

【発明が解決しようとする課題】本発明は、このような問題を解決するためになされたものであり，その目的とするところは、ＣＡＶフォーマット記録を行う際に、記録範囲を損なうことなく、さらにティアドロップ形状に形成されたピットが再生に悪影響を及ぼすことを抑制する光情報記録装置を提供することにある。

【００１７】

【課題を解決するための手段】本発明は上記のような課題を解決するために考えられたもので，請求項１記載の光記録媒体記録装置は、光情報記録媒体と光ビーム発生手段を有する光学ヘッドとを相対的に移動しつつ、光情報記録媒体上に形成されている記録膜上に，光ビーム発生手段から出力された光ビームにて記録情報信号に対応するピットを形成して情報を記録する光情報記録装置において、光情報記録媒体上に記録している記録位置を検出する記録位置検出手段と，光ビーム発生手段を制御する制御手段とを有し、制御手段は、記録位置検出手段より出力される記録位置情報に応じて，光ビーム発生手段からの光ビームの出力を制御することを特徴とする。

【００１８】また、請求項２記載の発明は，請求項１記載の発明であって，制御手段は，ピットを形成する際、光ビーム発生手段から３値以上のパワーレベルをもつ光ビームを出力させ，記録位置情報に応じて光ビームの少なくとも最大のパワーレベルを変化させる。

【００１９】また，請求項３記載の発明は、請求項２記載の発明であって、制御手段は、ピットを形成する際、記録位置情報に応じて前記光ビームの発生開始時点、発生終了時点を可変可能とする。

【００２０】また，請求項４記載の発明は、請求項１乃至請求項３のいずれか一つの発明であって、制御手段は，ピットを形成する際，記録位置情報が所定の値よりも小さいときは，光ビーム発生開始時点、発生終了時点を，それぞれ記録情報信号の発生開始時点、発生終了時点よりも所定時間遅らせ、記録位置情報が所定の値よりも大きいときは，光ビーム発生終了時点を所定時間遅らせるように制御する。

【００２１】また、請求項５記載の発明は、請求項１乃至請求項４のいずれか一つの発明であって　記録位置検

出手段は、記録情報信号に含まれる情報に基づいて記録位置を検出する。

【００２２】また、請求項６記載の発明は、請求項１乃至請求項４のいずれか一つの発明であって、記録位置検出手段は、光情報記録媒体に予め記録された情報に基づいて検出する。

【００２３】また、請求項７記載の発明は、光ビーム発生手段から出力された光ビームにて記録情報信号に対応するピットを形成することにより情報を記録する光情報記録媒体において、光情報記録装置からの光ビーム出力を変化させるための制御情報が予め記録されている。

【００２４】また、請求項８記載の発明は、請求項７記載の発明であって、制御情報が、時間情報である。

【００２５】また、請求項９記載の発明は、請求項７記載の発明であって、制御情報が、位置情報である。

【００２６】

【作用】請求項１記載の発明によれば、光情報記録媒体と光ビーム発生手段を有する光学ヘッドとを相対的に移動しつつ、光情報記録媒体上に形成されている記録線上に、光ビーム発生手段から出力された光ビームにて記録情報信号に対応するピットを形成して情報を記録する光情報記録装置において、光情報記録媒体上に記録している記録位置を検出する記録位置検出手段と、光ビーム発生手段を制御する制御手段とを有し、制御手段は、記録位置検出手段より出力される記録位置情報に応じて、光ビーム発生手段からの光ビームの出力を制御するので、記録位置に応じて光ビームの出力を制御することが可能となる。

【００２７】また、請求項２記載の発明によれば、制御手段は、ピットを形成する際、光ビーム発生手段から２値以上のパワーレベルをもつ光ビームを出力させ、記録位置情報に応じて光ビームの少なくとも最大のパワーレベルを変化させるので、光ビームの最大のパワーレベルが定格値を超えないように制御することが可能となる。

【００２８】また、請求項３記載の発明によれば、制御手段は、ピットを形成する際、記録位置情報に応じて前記光ビームの発生開始時点、発生終了時点を可変可能とするので、記録位置に応じて光ビームの発生タイミングを制御することが可能となる。

【００２９】また、請求項４記載の発明によれば、制御手段は、ピットを生成時、記録位置情報が所定の値よりも小さいときは、光ビーム発生開始時点、発生終了時点を、それぞれ記録情報信号の発生開始時点、発生終了時点よりも所定時間遅らせ、記録位置情報が所定の値よりも大きいときは、光ビーム発生終了時点を所定時間遅らせるように制御するので、記録位置に応じて光ビームの発生タイミングを制御でき、熱エネルギー不足によるピットの歪みが原因で生じる再生信号の時間的なずれを解消できる。

【００３０】また、請求項５記載の発明によれば、記録位置検出手段は、記録情報信号に含まれる情報に基づいて記録位置を検出するので、簡単な構成で光ビームの出力パターンを制御することができる。

【００３１】また、請求項６記載の発明によれば、記録位置検出手段は、光情報記録媒体に予め記録された情報に基づいて検出するので、簡単な構成で光ビームの出力パターンを制御することができる。

【００３２】また、請求項７記載の発明によれば、光ビーム発生手段から出力された光ビームにて記録情報信号に対応するピットを形成することにより情報を記録する光情報記録媒体において、光情報記録装置から出力される光ビームの出力パターンを変化させるための制御情報が予め記録されているので、これを記録再生する装置が簡単な構成で実現できる。

【００３３】また、請求項８記載の発明によれば、制御情報が、時間情報であるので、これを記録再生する装置が簡単な構成で実現できる。

【００３４】また、請求項９記載の発明によれば、制御情報が、半径情報であるので、これを記録再生する装置が簡単な構成で実現できる。

【００３５】

【発明の実施の形態】以下、本発明の実施の形態を図面を参照しつつ説明する。

第１の実施の形態

本発明の第１の実施の形態では、前述した３値信号により記録を行う場合を例に説明する。

【００３６】図４は、第１の実施の形態の光情報記録装置において、入力された記録データ信号に応じて、記録用の光ビームを出力する３値信号生成回路のブロック構成例を示したものである。なお、光情報記録装置の他の部分は従来より公知と知られている装置にて構成することが可能であるので、その図示、説明を省略する。

【００３７】図４における３値信号生成回路は、記録データ信号入力部４０１、記録補償手段４０２、電圧−電流コンバータ４０３及び４０４、加算器４０５、光ビーム発光素子４０６、Ｄ／Ａコンバータ４０８及び４０９、半径検出手段４１０、及び各部の制御を行う制御部４０７から構成される。また、記録補償手段４０２は、さらにパターン判別回路４１１、補正パルス発生器４１２から構成される。

【００３８】パターン判別回路４１１は、記録データ信号入力部４０１より入力された記録データ信号（情報ビット列）に応じて、３値信号の基本部分、即ち電圧値Ｄ１の矩形波を生成する。

【００３９】半径検出手段４１０は、記録半径を検出し、それを記録半径情報として制御部４０７へ供給する。

【００４０】制御部４０７は、半径検出手段４１０から供給された記録半径情報に基づいて、それに応じた光ビームの出力レベルを得るための駆動信号（デジタル信

号）をＤ／Ａコンバータ４０８、４０９に出力するとともに、補正パルス発生器４１２に記録半径情報を供給する。

【００４１】補正パルス発生器４１２は、制御部４０７より供給された記録半径情報に応じて、３値信号の内の出力増加分，即ち電圧値Ｄ２の矩形波を生成する。

【００４２】Ｄ／Ａコンバータ４０８、４０９は制御部４０７から入力されたデジタル信号をアナログ信号のＥ０、Ｅ１に変換し、電圧－電流コンバータ４０３、４０４へそれぞれ供給する。

【００４３】電圧－電流コンバータ４０３，４０４は、記録補償手段４０２からの電圧値Ｄ１、Ｄ２及び制御部４０７からの電圧値Ｅ０、Ｅ１に対応した電流値を生成し、加算器４０５へ供給する。

【００４４】加算器４０５は入力された２つの電流値を加算し、加算値を駆動電流信号として光ビーム発光素子４０６へ供給する。

【００４５】なお、上述のＤ１、Ｄ２、Ｅ０、Ｅ１と光ビーム発光素子４０６から出力される３値信号の波形（図６）との関係は，基本部分である矩形波の幅Ｗ１、高さＨ１は、それぞれ矩形波Ｄ１のパルス幅、Ｅ０の大きさに応じて決まり、出力増加分の矩形波の幅Ｗ２、高さＨ２は，それぞれ矩形波Ｄ２のパルス幅、Ｅ１の大きさに応じて決まる。

【００４６】次に、このように構成された３値信号生成回路における具体的な動作を図１、図２を用い説明する。図１（ａ）は，本実施の形態の３値信号生成回路（図４）により記録を行う場合に、半径検出手段４１０にて検出される記録半径（横軸）と光ビーム発光素子４０６が出力する光ビーム出力のパワーレベル（縦軸）との関係を示し、図１（ｂ）は、そのときの光ビーム出力パターンの一例を示し、さらに図１（ｃ）は、そのときのｄＰ（Ｐ１とＰ０との差分）の変化パターンの一例を示す。

【００４７】なお，図１（ａ）の記録半径は右へ行くほど記録媒体の外周へ向かうものとし，また，図１中Ｐ０、Ｐ１、ｄＰ、Ｒ１、Ｒ２は、図９、図１０と同様のものを指しているものとする。図４の３値信号生成回路の動作は主に制御部４０７の制御により行われおり、以下、制御部４０７の動作を中心に説明していく。

【００４８】まず制御部４０７は，半径検出手段４１０より供給される記録半径情報と３値信号による記録時の記録半径の限界値Ｒ１とを比較し、記録半径情報がＲ１より小なる場合は，図１（ｃ）に示したように、図１（ｂ）のｄＰ，即ち３値信号の出力増加分が一定値になるようにＰ１レベルを求め、電圧－電流コンバータ４０４に所定の電圧値を供給する。

【００４９】一方，記録半径がＲ１より大なる場合は、図１（ｂ）のＰ１の値が光ビーム発光素子４０６の動作限界値Ｍａｘ　Ｐｏｗｅｒを超えないように記録半径に応じてｄＰを計算し、そのｄＰ値に基づいたＰ１のレベルを求め、電圧－電流コンバータ５０４にそのレベルを出力するための電圧値を供給する。

【００５０】この例は図１（ｃ）に示したように、ｄＰの値を記録半径がＲ１に達した後で直線的に減少するように制御を行う場合であり，かかる制御を行えば、図１（ａ）の実線に示したように光ビーム発光素子４０６の出力のパワーレベルが、記録半径が外周にいくに従い増加し，Ｐ１のレベルがＭａｘ　Ｐｏｗｅｒ（記録半径Ｒ１）に達した後は一定値になるので、光ビーム出力のレベルがＭａｘ　Ｐｏｗｅｒを超えないように制御することが可能となる。

【００５１】なお、ｄＰの変化パターンは図１（ｃ）に示した例に限らず、Ｐ１がＭａｘＰｏｗｅｒを超えないという条件を満たせば、図２（ａ）～（ｃ）のようなパターンでも本実施の形態に適用可能であることは言うまでもない。つまり、図２（ａ）は，ｄＰを記録半径Ｒ１までは直線的に増加させ、Ｒ１を過ぎると直線的に減少させるパターンを示し、図２（ｂ）は，始めから終りまでｄＰを直線的に減少させるパターンの場合を示す。

【００５２】また，図２（ｃ）は、Ｒ１まではｄＰを一定値とし、記録半径がＲ１を超えたらｄＰを０とする場合である。このような構成にすれば、ｄＰをＯＮ／ＯＦＦするのみであるので，回路構成が簡単になり、安価に実現可能であるという利点がある。ただし、図２（ａ）、（ｂ），（ｃ）いずれの場合も、光出力はＭａｘ　Ｐｏｗｅｒを超えないように設定することはもちろんである。

【００５３】以上説明したように，第１の実施の形態では，記録半径に対応して光ビーム出力のパターンを変更できるように構成したので，従来では図１の記録半径Ｒ１までしか記録できなかったところを、Ｒ２まで記録可能とすることが可能となり、記録範囲が損なわれるということは無くなる。また、前述したような光ビーム出力のパターンの変更により，光ビームの出力レベルをＭａｘ　Ｐｏｗｅｒ以下に抑えることができるので、光ビーム発光素子の破壊や劣化を防ぐことができる。

【００５４】なお、第１の実施の形態においては、光ビーム出力がＭａｘ　Ｐｏｗｅｒを超えないようにする手段として、半径検出手段４１０から入力された記録半径情報を制御部４０７が監視する構成を示したが、別の方法として、半径検出手段を使用する代わりにリミッタを加算器４０５の出力部分に配し、光ビーム発光素子４０６にＭａｘ　Ｐｏｗｅｒを超えるパワーレベルを出力させる駆動信号が加算器から入力されたとしても、リミッタにてその信号を遮断するように構成することも可能である。

【００５５】つまり，図３に示すように、記録媒体の内周部、中周部、外周部を問わず，３値信号のＰ１とＰ０との差分ｄＰを変化させずに光ビームの駆動信号を出力

し、駆動信号は光ビーム発光素子へ入力される前にリミッタにて所定のリミットレベル（例えばＭａｘ　Ｐｏｗｅｒレベル）以上の信号を遮断するのである。このような構成にすることにより，半径検出回路４１０が不要になり安価に装置を構成でき、また制御部４０７は記録半径を監視する必要がないので３値信号生成にあたってのオーバヘッドの軽減につながる。

【００５６】また，本実施の形態により３値信号にてＣＡＶフォーマット記録を行った場合、記録位置Ｒ１よりも外周部では、光ビーム出力の出力増加分ｄＰの量が減り、記録開始端において十分な熱エネルギーが得られないために，形成されるピット形状が歪み、所望のピット形状が得られないと思われる。このような歪んだ形状のピットを再生した場合の動作を図７を用いて説明する。

【００５７】図７（ａ）、（ｂ）は、それぞれＲ１より内周部、外周部に，同一の記録データ信号に対して記録を行った場合における、光ビームの出力パターン、形成されるピットの形状、そのピットを再生した時の再生波形、及びそれを所定の閾値Ｔｈで２値化した信号の関係を示す図である。

【００５８】図７（ａ）を見てもわかるように，Ｒ１より内周部においては所望の形状のピットが形成されるので、これを再生し，再生波形を２値化した信号は、記録データ信号と時間的なずれは生じていない。

【００５９】しかし、図７（ｂ）に示したようにＲ１より外周部においては、ピットの記録開始端の幅が歪んで形成されるので、これを再生した場合，記録開始端での変調度が低く再生波形の立ちあがりが緩やかになり、閾値Ｔｈを越える点，即ち再生側が立ち上がりエッジであると認識する点が本来の記録データ信号の立ち上がりエッジよりもｄＴだけ遅延することになる。

【００６０】しかし、ＣＡＶフォーマットの場合は外周部へいくに従い線速度が速くなるので，形成されるピットの長さが長くなり，それだけピット全長に対する歪みの長さが占める割合が低くなる。ゆえに、かかるピットの形状を再生時，その歪みが再生信号へ与える影響は小さくなるのでほとんど問題にはならない。

【００６１】<u>第２の実施の形態</u>

次に示す第２の実施の形態は、このようなピットの形状の歪みが再生信号へ与える影響をも除去しようとするものである。

【００６２】第１の実施の形態と異なるところは、記録半径が予め設定した値より大きくなった場合は図１のｄＰの大きさを変化させることに加えて，ピットの記録開始時点を実際の記録開始時点よりも前にずらす点であり、こうすることにより再生側が認識する再生信号の立ち上がりエッジの遅れを補正しようとするものである。これを実現するために、本実施の形態は、前述した図４の記録補償手段４０２の構成の中にさらにエッジ位置シフト手段を追加している。

【００６３】図６（ａ）にその構成の一例を示す。　なお、図６（ａ）においては，記録補償手段以外の構成については図４と同一であるのでその図示、及び説明を省略してある。エッジ位置シフト回路６０１は、制御部４０７の制御によりパターン判別回路４０１の出力信号の立ち上がりエッジ，立ち下がりエッジの時間的な位置を変化させるものである。

【００６４】かかる構成にて記録を行う際の動作を、図６（ｂ）及び図６（ｃ）を用いて説明する。なお、本実施の形態では、３値信号による記録を行い，光ビーム出力のパワーレベルは図１（ａ）の如く変化するものとして説明する。

【００６５】図６（ｂ），図６（ｃ）は、記録データ信号入力部４０１より入力される記録データ信号と、エッジ位置シフト回路６０１からの出力信号Ｄ１と、補正パルス発生器４１２からの出力信号Ｄ３と、光ビーム発光素子４０６より出力される光ビームの出力パターンとのタイミングの関係を示したものであり、図６（ｂ）は図１（ａ）のＲ１より内周部、図６（ｃ）はＲ１より外周部で記録を行った場合を示す。

【００６６】まず，制御部４０７は、半径検出手段４１０より検出された記録半径とＲ１とを比較する。

【００６７】記録半径がＲ１より小なる場合は、図１（ａ）のように外周部に行くに従い光ビーム出力のパワーレベルを増加させ，ｄＰ値が一定になるように制御すると共に、図６（ｂ）に示したように、エッジ位置シフト回路６０１を制御して光ビーム出力パターンの立ち上がりエッジ、立ち下がりエッジ、つまり記録開始点、記録終了点の両方を遅延させる。

【００６８】一方、記録半径がＲ１より大なる場合は、ｄＰを記録半径に応じて変化させることにより，光ビーム出力のパワーレベルがＭａｘ　Ｐｏｗｅｒレベルを超えないように制御すると共に，図６（ｃ）に示したように，立ち下がりエッジ、つまり記録終了点のみを遅延させる。すなわち，Ｒ１より内周部では、光ビームの出力パターンのタイミングが記録データ信号よりも全体的にｄＴだけ遅延するように制御し（図６（ｂ））、Ｒ１より外周部では，光ビームの出力パターンの立ち下がりエッジのみが記録データ信号の立ち下がりエッジよりもｄＴだけ遅延するように制御する（図６（ｃ））。

【００６９】その結果，この構成にて同一の記録データ信号を記録する場合、光ビームの出力パターンは，Ｒ１より内周部よりも外周部の方がその立ち上がりエッジがｄＴだけ先行し、立ち下がりエッジは両者とも揃うことになる。

【００７０】かかる光ビームの出力パターンにて形成されるピットの形状、それを再生したときの再生波形，及びそれをある閾値にて２値化したときの信号波形を図８を用いて説明する。

【００７１】図８は、同一の記録データ信号に対して記

録を行った場合における、光ビーム出力パターン、形成されるピットの形状、そのピットを再生した時の再生波形、及びそれを所定の閾値Ｔｈで２値化した信号の関係を示す図であり、図８（ａ）は、本実施の形態において、Ｒ１より内周部に記録を行ったときの各動作、図８（ｂ）は、本実施の形態において、Ｒ１より外周部に記録を行ったときの各動作を表す。

【００７２】図８（ａ）に示したように、本実施の形態にて、Ｒ１よりも内周部に形成されたピットの始端は、記録データ信号の立ち上がりエッジよりもｄＴ分だけ遅延している。

【００７３】一方、図８（ｂ）に示したように、Ｒ１よりも外周部に形成されたピットの始端は、記録データ信号の立ち上がりエッジと時間的に同じ位置であり、ピットの終端は立ち下がりエッジよりもｄＴ分だけ遅延する。

【００７４】したがって両者を比較してみると、Ｒ１より外周部に形成されたピット（図８（ｂ））は、Ｒ１より内周部に形成されたピット（図８（ａ））と比較して、その始端が時間的にｄＴだけ先行している。ゆえに、Ｒ１よりも外周部のピットを再生した場合は、図８（ｂ）に示したように、最初はその始端でのピットの歪みの影響により変調度が低くなるために再生波形の立ち上がりが緩やかになり、所定の閾値Ｔｈに達する時点、つまり２値化した信号の立ち上がりエッジＨｃが記録データ信号の立ち上がりエッジよりもｄＴだけ遅延する。また、再生波形の立ち下がりはピットの終端と同位置になるため、２値化した信号は記録データ信号の立ち下がりエッジＬｃよりもｄＴだけ遅延する。つまり、再生波形を２値化した信号は、立ち上がり、立ち下がりエッジの両者とも記録データ信号のそれよりもｄＴだけ遅延する。

【００７５】また、Ｒ１よりも内周部のピットを再生した場合は、ピットが所望の形状に形成されているため、図８（ａ）に示したように、再生波形の立ち上がり、立ち下がりはピットの始端、終端と一致するため、２値化した信号は両者（Ｈｂ，Ｌｂ）とも記録データ信号の立ち上がり、立ち下がりエッジよりもｄＴだけ遅延する。

【００７６】したがって、光ビーム出力の立ち上がり、立ち下がりエッジのタイミング制御を行わないで記録を行った場合は、図７（ａ）、（ｂ）で示したように、Ｒ１よりも内周部と外周部とで、形成されたピットからの再生信号（再生波形を２値化した信号）の立ち上がりエッジにｄＴ分だけのずれが生じていたが、本実施の形態にて記録を行うことにより、再生波形を２値化した信号の波形は、Ｒ１より内周部でも外周部でも、記録データ信号よりも全体的にｄＴだけ遅延することになり、再生時の時間軸上のずれが解消され、同一の条件で再生されることになる。

【００７７】以上説明したように、第２の実施の形態によれば、ピットの記録開始点を実際の記録開始点よりも時間的に前にずらすことにより、形成されたピットの歪みにより再生側が認識する再生信号の立ち上がりエッジの遅れが補正されるのである。

【００７８】上述の記録開始端、終了端のシフト分ｄＴは、例えば記録データ信号の立ち上がりエッジから再生波形が閾値Ｔｈを超えるまでの時間を記録半径に応じて測定し、求めることが可能である。

【００７９】なお、第２の実施の形態では、ｄＰの変化パターンが図１（ｃ）のような場合に適用したが、これに限らず、他の変化パターン（図２（ａ），（ｂ），（ｃ）など）にも適用可能である。特に図２（ｃ）のように、ｄＰが急激に変化する例では、記録半径Ｒ１の位置にていきなりｄＰが０になってしまい、再生装置側がその急激な変化に追随しきれなくなる場合が生じるので、このような例に対してはたいへん有効であることは当然である。

【００８０】もちろん、内外周部すべてにおいて２値信号で記録する場合に第２の実施の形態を適用することで同様の効果を得ることが可能であるが、図１１に示すように、内周部（図１１（ａ））ではピット全体に対する歪みの部分ＬＥの占める割合が、外周部の場合（図１１（ｂ））よりも大きいので、光ビームの発生タイミングの誤差に対する記録、再生信号への影響が大きいために、記録、再生時に装置の外部等から加わるノイズのために正しく記録、再生できなくなる場合がある。そのために第２の実施の形態では、内周部では従来の３値信号による記録を行い、上述のピット歪みの影響が低い外周部において本実施の形態を適用したのでこのような問題は起こらない。

【００８１】また、第１、第２の実施の形態において、記録半径を検出するために専用の半径検出回路４１０を用いたが、プリグルーブ等に予め記録されている絶対時間情報や記録する信号のアドレス情報、記録時間などの情報から算出しても検出可能なことは言うまでもない。

【００８２】さらに、第１、第２の実施の形態において、光ビーム出力のパターンを変化させるための制御情報を予め光情報記録媒体に記録しておくことにより、その制御情報を読み出して所望の記録制御をなすことができることはもちろんである。

【００８３】

【発明の効果】以上説明したように、本発明によれば、第１の実施の形態にて述べたように、記録半径に応じて光ビームの出力のパワーレベルを変化させることにより、光ビームの最大のパワーレベルが定格値を超えないように制御することが可能となるので、記録媒体中の記録可能な範囲を損なうことが避けられる。また、第２の実施の形態にて述べたように、記録半径に応じて光ビームの発生タイミングを制御することが可能となり、熱エネルギー不足によるピットの歪みが原因で生じる再生信

号の時間的なずれを解消できる。

【図面の簡単な説明】

【図1】本発明の第1の実施の形態における光情報記録装置の光ビームの出力レベルと記録半径との関係を示す図である。

【図2】本発明の第1の実施の形態における光情報記録装置の光ビーム出力の記録半径に対する変化を示す図である。

【図3】本発明の第1の実施の形態における光情報記録装置の光ビームの出力レベルの動作を示す図である。

【図4】本発明の第1の実施の形態における光情報記録装置の一例を示す図である。

【図5】本発明の第1の実施の形態における光情報記録装置の光ビームの出力パターンの一例を示す図である。

【図6】本発明の第2の実施の形態における光情報記録装置の一例、及びその光ビーム出力パターンを示す図である。

【図7】本発明の第2の実施の形態における光情報記録装置の動作を示す図である。

【図8】従来の光情報記録装置の動作を示す図である。

【図9】従来の光情報記録装置の動作を示す図である。

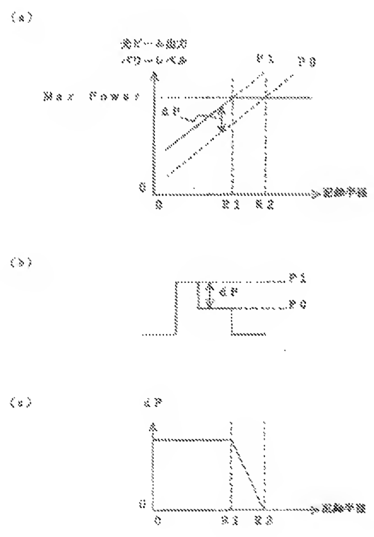
【図10】本発明の第2の実施の形態の動作を示す図である。

【図11】本発明の第2の実施の形態において、記録媒体に形成されるピットの形状を示す図である。

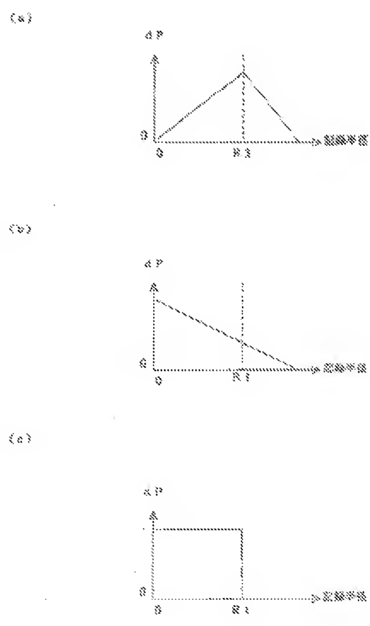
【符号の説明】

401・・・・・・・・記録データ信号入力部
402・・・・・・・・記録補償手段
403，404・・・電圧−電流コンバータ
405・・・・・・・・加算器
406・・・・・・・・光ビーム発光素子
407・・・・・・・・制御部
408，409・・・D／Aコンバータ
410・・・・・・・・半径検出手段
411・・・・・・・・パターン判別回路
601・・・・・・・・エッジ位置シフト回路

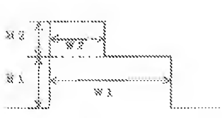
【図1】



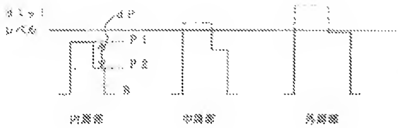
【図2】



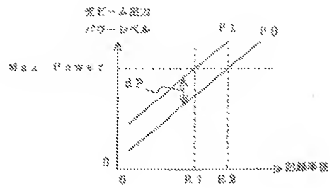
【図5】



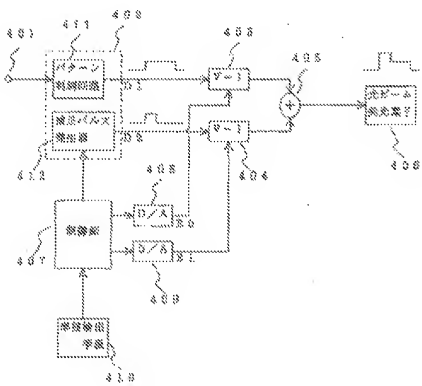
【図3】



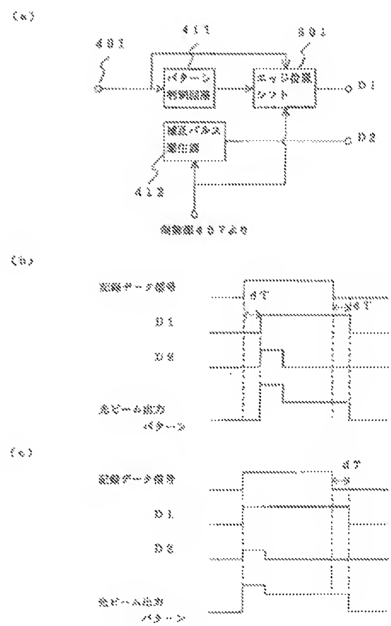
【図10】



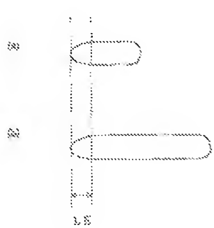
【図4】



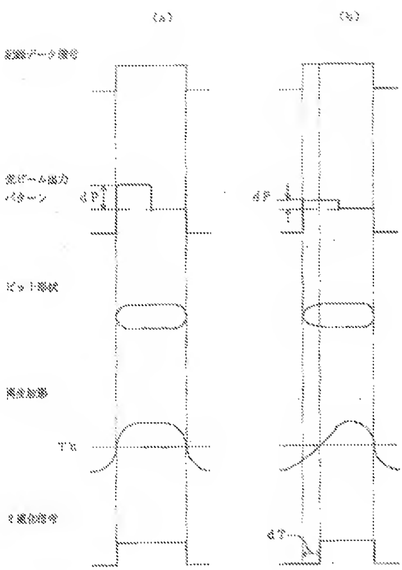
【図6】



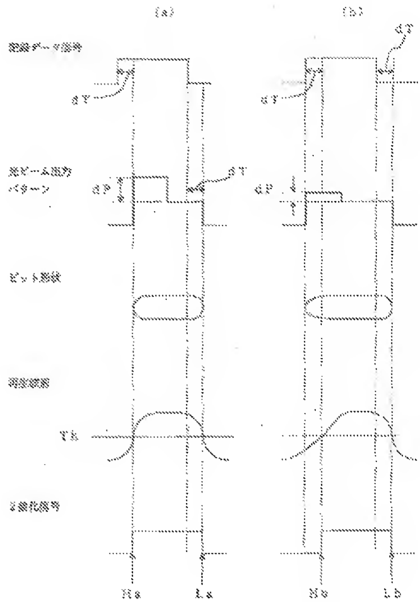
【図11】



【図7】


(a)
(b)
記録データ信号
光ビーム出力パターン
dP
ピット形状
再生波形
Th
2値化信号
dT

【図8】


(a)
(b)
記録データ信号
dT
光ビーム出力パターン
dP
ピット形状
再生波形
Th
2値化信号
Ha
La
Hb
Lb

【図9】